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The HUMBLE WAY

MARCH-APRIL, 1946

The HUMBLE WAY

Vol. 1 MARCH-APRIL No. 6

PROGRESS IN SAFETY

SAFETY has a short history but a long past. As an idea, it doubtless had its origin in the mind of aboriginal man; since accidents are as old as man himself. Through the ages he learned elemental rules of self-preservation, which, if followed, would assist considerably his efforts in living comfortably to his allotted three score and ten.

However, organized accident prevention was not born until the advent of the era in history known as the Industrial Revolution, and then it did not gain proportions of a movement until there developed in society an awareness of the coincidence of certain types of accidents with mechanization.

There was initiated on the part of government agencies and industry itself a program to guard against these first recognized hazards. Since those beginning years, accident prevention has traveled the painful road of trial and error, through numerous stages of development, until today it is recognized as an engineering science which is an indispensable part of industry.

The stages of development, for the sake of brevity, will be classified here as: first, the guard era; then, second, the evangelistic era; and, finally, the era in which we live today, the stage of awareness of the personal element, the era of individual responsibility.

At the outset of this move for industrial safety, those interested in preventing accidents thought of it as merely a problem of guarding against obvious hazards, and they aimed their work primarily at movable parts of machinery. Typical of the early approach to the problem was the general feeling that if guards were placed on machinery and the obvious mishaps prevented, ipso facto, no more accidents.

Then it came to be a common practice to purchase machinery with guards installed at the factory. That did not solve the accident problem. There still were accidents, even with the safest equipment obtainable.

Of course accident prevention could advance only as progress was made in technology, psychology and other fields.

Thus it was, as more was learned about people, particularly the psychology of human behavior, that there gradually developed a better understanding of the personal problem in accident prevention as distinguished from the rather obvious problem of placing guards on machinery.

With this understanding, accident prevention moved into what might be termed the evangelistic era. Industry became acutely sensitive to the need for individual care in preventing accidents. It was an era of enthusiastic climbers-on to the accident prevention bandwagon. Employees in industry were exhorted to "be careful." They were told even how to "be careful."

However, it became obvious that in safety, as in religion, people couldn't be saved by telling them to be safe; they wouldn't take care simply because they were told how to take care.

It was realized, at last, that preventing accidents was a matter of changing the thinking habits of people, of having them understand that from an educational standpoint, as well as a moral viewpoint, safety is an individual responsibility in almost every case.

We in the United States have always thought of ourselves as being in the vigor of youth. The willingness to take risks, to face the challenge of the unknown, is typically American. That type of thinking is imperative for the taming of the wilderness, the hewing of a new world, but transplanted to the age of machines and industrial employment, it is not conducive to safe working practices. And it is this psychology the safety engineer has had to combat.

Such an attitude was particularly prevalent during the ealier stages of formalized work in safety. Employees in industry, especially oil-field employees, and more especially those on drilling rigs, assumed a spirit of bravado insofar as safety precautions were concerned. They more or less scoffed at the idea of safety and the prevention of accidents, feeling that it was "sissy stuff."

However, as time went on, they were impressed by the fact they owed it to fellow employees and to themselves to work for safety. Some of these men who were the hardest to sell on the thought of working safely to protect themselves became amenable to the idea that carelessness and unsafe practices on their part might not only jeopardize their lives but also the lives of those who were working with them.

Soon employees working in groups demanded individual safety of each other. Soon after that, it was generally recognized that an unsafe worker was not wanted either by the employer or the employee.

There is no actual date to mark this passing of the industrial safety idea from the age of evangelism to the more enlightened era of individual responsibility in which we live today. In the United States the organization of safety work as a force that would touch the life of virtually every American citizen came with the founding of the National Safety Council in 1913, near the end of the evangelistic era. The council has been the unifying agency for accident prevention since its founding, and its organization doubtless

SURFACE GEOLOGISTS today study outcrops for the type of rock and also to note whether or not fossils occur in the rock.

hastened the country's advance into the present stage of safety engineering work.

Concurrently with this stage of awareness of the personal element in accident prevention, safety engineering has taken long strides as a profession. The education of the industrial worker has improved, and through trial and error the safety engineers have come to adopt those approaches that have been found successful and to discard those found lacking.

They have taken advantage of technological advances to improve safety techniques and approaches. For instance, as a result of the development of non-shattering glass for goggles, wearing of these goggles for eye protection has become a very common practice in industry. Too, there was the development of safety hats—hats light enough to wear comfortably yet strong enough to serve safety purposes. These hats too have become a common item of personal protection equipment, and have proved themselves worthy of acclaim over and over again in actual cases of lives saved or critical injuries averted. Another classic example is the development of the safety shoe, which has prevented many a serious injury.

Also, safety engineers have made greater use of visual aids in recent years as an adjunct to safety education as well as job training, of which safety is a part. National organizations that have an interest in accident prevention have taken advantage of the visual aid procedure, and as a result there has been made available to the general public quite a large amount of source material, as well as special visual aids such as posters, pictures, motion pictures, slide films, and slides, used in preventing accidents.

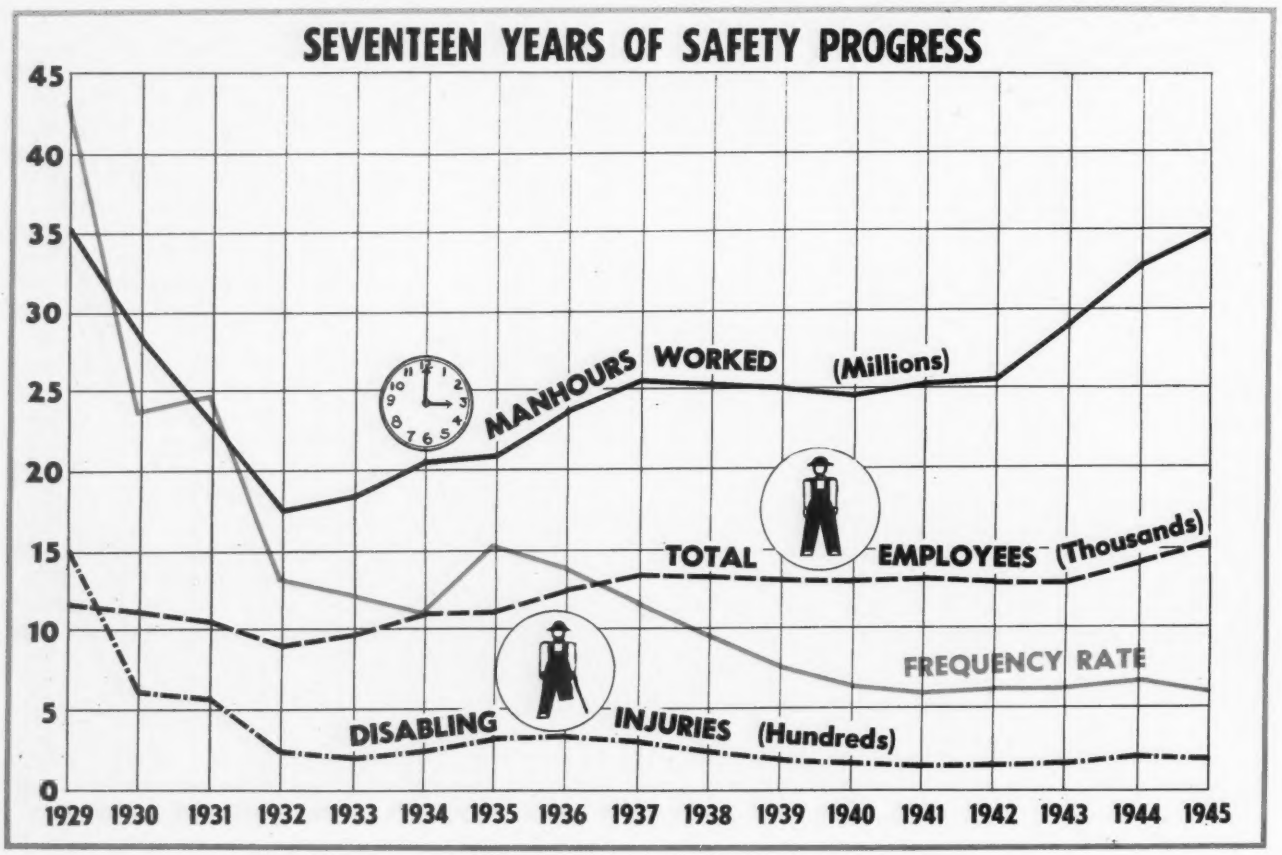
Typical of the era is the adopted truism that safety is inherently an integral part of doing a job. If a job is done right, it is done safely.

Safety engineers learned that it is almost axiomatic if a man is not properly instructed—does not have the necessary knowledge to do a job efficiently and correctly—the stage is set right there for an accident. That's why there has been a general move to correlate the safety and training aspects in industry and why training has become the major activity of the safety engineer.

It is a comparatively simple process to trace the steps in the history of the industrial safety movement, but it is difficult to measure the progress being made. Safety engineers tell us safety progress may be won with a great deal of difficulty and lost easily.

The science of accident prevention—safety engineering—is not an exact science. It isn't something you can put in a test tube and find the answer, because you are dealing with people, with multitudinous personalities and individual reactions. And, as safety men say, you have to be on your toes constantly if you are to keep ahead of *old man accident;* for with death and taxes, he's always on your doorstep, waiting.

Also, they explain, safety work has a peculiar aspect in that its best results are measured in zeros; zeros on accident reports, figures that are the aim of every safety engineer. However, they explain, "if you have no accidents, you shouldn't have had them anyway. If you have some accidents, you still have no way of knowing how much good your work has accomplished. You can only feel that perhaps if you had not done what you did, you would have been faced with more accidents."



WALKWAYS OVER machinery and equipment are made of safety grating to insure good footing. Outfitted to do the job—wearing safety hat, goggles ,gloves—the employee below, like all other Humble employees, has been taught that safety is a natural part of his work.

It may be difficult to measure progress in accident prevention, as the safety engineer declares, but we can theorize as far as statistics go. Since the figures are available, let's take the record of the Humble Companies as a yardstick of accident prevention, at least in the petroleum industry.

It is a matter of record that in the busy final war year of 1945 when Humble men and women were working under pressure to turn out vitally needed war materials, Humble enjoyed the lowest frequency accident rate in the history of the organization.

For every million man-hours worked during last year there were 5.96 disabling injuries, the lowest average in Humble history. This figure is just a fraction better than the previous record of 5.97 disabling injuries for every 1,000,000 man-hours worked in 1941; however, real progress is shown when you consider there were 43.21 disabling accidents for every million man-hours worked in 1929, the earliest year for which detailed records are available.

Since 1929 there has been a total of 5,899 disabling injuries in the Company, with a steadily decreasing frequency rate. Had the 1929 frequency rate persisted since that time and had employees worked the same number of hours, there would have been 18,821 disabling injuries to Humble men and women by the first of this year.

That is, quoted in figures, a net saving of 12,900 disabling injuries. It is impossible to judge in terms of weights and measures the extent of human suffering, of heartbreak and of sorrow which too often accompany accidents. Consequently there can be no accurate summation of the net saving realized because of the safety consciousness of the age in which we live and because of the work of a group of men and women who care enough to help lead their fellow employees into paths of safer work.

Accident prevention has been a part of the Humble program since its incorporation in 1917, near the end of the evangelistic era in the safety movement. While much of the growth of the industrial safety idea was experienced prior to the Company's organization, Humble has been a leader and a champion of the cause from its earliest days as a corporate business.

Humble always has held a high rating in standings issued by the American Petroleum Institute and by the National Safety Council. Its various departments have won numerous plaques, certificates, and citations attesting to the heartening response on the part of the employees to the safety work being carried on in their behalf.

In the early years of the Company's history, there was one individual charged with safety responsibilities for the Humble Pipe Line Company, one for the Production department and one for the Baytown refinery. With the growth and expansion of Company operations, safety work expanded to meet the need to advise operating personnel, for an adequate program of safety development, and for staff consultations. As the awareness of the personal responsibility factors in safety became more and more apparent, the training aspects of safety work were emphasized, and the merger of the safety program and the job training program of the company into one department seemed to be a logical step.

So it was that in 1938, the Safety and Training Division

was established under one head, and today forty individuals make up the staff of this vital organization.

The Safety and Training Division has at least one safety engineer in every geographical division and in some areas two. Among their many duties is the development of an organized program of safety meetings throughout most of the Company's operations. Meetings are held on the average of once a month and are designed to give employees the opportunity of discussing their work with the thought of improving it from the standpoint of efficiency and safety.

The meetings afford the safety engineers an opportunity of calling to the attention of employees aids to safety methods and procedures to be used not only on the job but off the job as well. In many localities special home safety programs are an annual event. At these meetings employees' families come to discuss a balanced program of off-the-job accident prevention to supplement the industrial accident prevention movement.

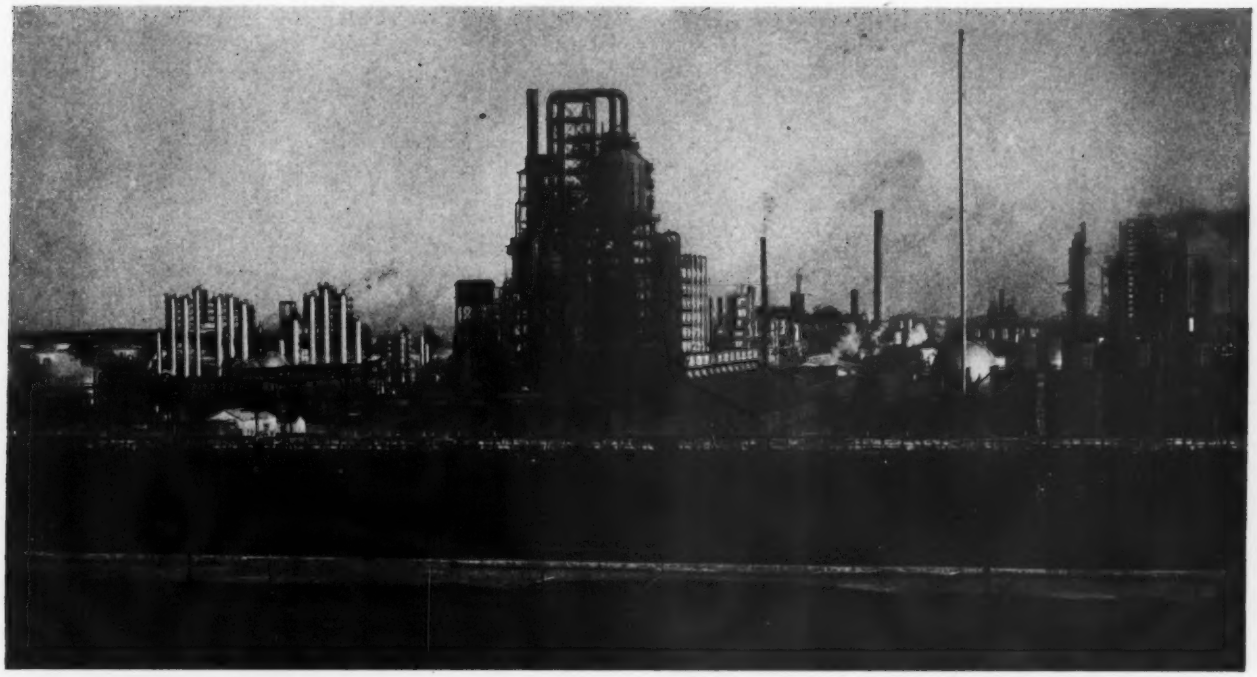
The Division also publishes monthly a magazine, *Safety Information*, which is circulated to supervisors and chairmen of employees' safety meetings. This magazine contains safety suggestions and information and news slanted to the safety story. It has proven to be a valuable aid in developing the safety consciousness apparent in Humble employees.

Visual education has been utilized to great advantage in Humble's safety and training programs. The Division, in addition to using posters, pictures, motion pictures, slide films and slides from outside sources, has its own visual aid section, which produces safety films and other training devices.

Through the Coin-Your-Ideas Plan, employees are encouraged to present their own safety ideas and suggestions in return for cash awards.

That Humble people are developing a keen awareness of the importance of safety precautions in their daily work is evidenced in the record of the past year. Perhaps few take the long, slow look back through the years of struggle and persevering effort, of trial and error, that have brought them to this memorable accomplishment, but they are beginning to realize that "it *can* happen here," that safety techniques and procedures aren't devised just to complicate their lives, but rather to save them. And best of all they are taking for granted that safety is a natural part of their work.

CREW MEMBERS GATHER AROUND TOOL PUSHER ON DRILLING RIG FLOOR FOR REGULAR MONTHLY SAFETY MEETING



OVERSHADOWED BY BAYTOWN REFINERY SKYLINE, FOREGROUND TOWERS SUPPLY COOL WATER FOR THERMAL CRACKING

Quenching a BIG Thirst

Supplying water for the continuous operations at Baytown refinery is a Gargantuan task

THE story is told of a somewhat apathetic gentleman, who, when first viewing the Pacific Ocean, was heard to remark, a bit disappointedly: "Well, it isn't as big as I thought it might be."

Similarly, visitors preparing themselves for a tour of Humble's Baytown refinery water systems have a right to expect great things. What they actually find is usually sufficient to satisfy the most hardened skeptic, for quenching the thirst of one of North America's largest oil refineries is a man-sized job.

One is startled to learn, for instance, that Baytown plants used more water last year than the city of Houston. Not just a little more; *over five million gallons a day more.* In 1945, Baytown's daily consumption was about 47½ million gallons; Houston's about 42 million.

More than 47 million gallons a day! That's a lot of water. Small wonder visitors find it difficult to evaluate water's importance in oil refining operations. The novice gropes for some common denominator, something to bring this apparently profligate use of water into clearer focus. As he does so, no memory serves so well as the impression gained when, as a small boy, he stood wide-eyed before bucket brigades watering herds of circus elephants. Then, the apparently interminable thirst of the great beasts had completely fascinated him; now, he is no less intrigued by the insatiable thirst of a refinery charging thousands of barrels of crude oil daily.

Ordinary uses—drinking, cleaning, bathing, and sewage—account for only a small portion of Baytown's daily gallonage. The great thirst is for water to cool hot oil vapors into liquids. Components for the oil and gasoline used in your car come in searing, blistering vapor streams from distilling and cracking plants—streams which must be cooled into liquids before they are sent on to the next refining phase or piped to storage. Hot vapor lines pass through some form of cooler or water-filled condenser, where water's coolness is traded for oil's heat.

From everywhere the water comes—from wells, from nearby bays and channels, and from the distant San Jacinto River. These sources supply three classes of water: ground, salt, and surface.

Ground water is trade terminology for well water. Fortunately, Baytown refinery perches above a porous sand stratum uniquely rich in ground water. Outcropping in the Crosby area 15 miles to the north and sloping southward to the sea, this layer of water-bearing sand takes with it that portion of the annual rainfall which percolates to its source. Since 1919, this dependable and prolific stratum has yielded up its treasure that Humble might keep Texans well-supplied

with quality oil products. Today, eleven wells, judiciously dispersed about the refinery and its environs—some of them sunk to depths of 500 feet—tap an unfailing supply of clear, cool water. These wells could, if necessary, produce 16 million gallons a day, perhaps more; but, to keep the static water level in the area from falling dangerously low under excessive withdrawals, actual daily production is nearer 14 million gallons.

Of the three types, well water is by far the most desirable for refinery uses because it contains natural carbonates which resist acidifying influence of chlorine injected into all cooling waters to control algae and bacteria (scum-forming) growths. Its relative purity and freedom from solids endear it to the boilerman's heart, for it needs less chemical treatment before conversion into steam. Finally, it comes from the ground clear and cool, with an average temperature of 76 degrees Fahrenheit.

Salt water supply problems are simplified by the refinery's well-planned location. Nearby bays and the Houston ship channel provide salt water in limitless abundance. Years ago, this was an even greater blessing than now. Then, condensers were predominantly of the open box type, where coils of hot oil lines twisted back and forth in a salt water bath. Water was used on a once-through basis; that is, hot salt water was simply discarded to the sewer. With the advent of new techniques and new equipment, however, salt water has lost a great deal of its usefulness as a cooling agent. Even so, some 16 million gallons a day continue to find employment in general fire protection operations, washing and cleaning, and in some of the remaining open condenser boxes still in use around shell stills and cracking coils.

The surface water system, the river-to-refinery chain of canals and reservoirs, was strictly a wartime necessity. Until 1943, refinery needs had been served adequately with ground and salt water. No one, of course, had foreseen the extent to which refinery facilities would mushroom under demands of a global war. Pressure was first felt in increasing demands for 100 octane aviation gasoline; mammoth new units to supply components for the 100 octane program were built within the refinery proper.

But wartime expansion did not end behind refinery fences. Humble complied with requests to build and operate for the United States Government three more plants adjoining Baytown refinery. The first of these was a large plant equipped to make synthetic toluene from oil. Toluene, it will be remembered, is the final "T" in trinitrotoluene, or TNT. Next came a plant to make butadiene, prime constituent of the Buna-S type synthetic rubber; finally, came a Butyl rubber plant.

The strain imposed by these additions upon current water supplies would have been too great. To answer the call for unprecedented amounts of new water, the San Jacinto River was tapped at a point about 16 miles north of Baytown. A pumping station there, some four miles from Crosby, sluiced water under the river and out into the first leg of a newly-constructed canal, about 11 miles long and terminating in a man-made lake located just half a mile from Highlands. Capacity of this reservoir, covering 1,100 acres and ranging in depth from three to eight feet, was two billion gallons. An uninterrupted supply of water to Baytown was assured.

From the Highlands reservoir, water could be tumbled down the remaining five miles of canal to Baytown at the rate of 50 million gallons a day. Just outside the refinery a second, smaller reservoir was built from which water was to be drawn as needed. This fresh water system bolstered Humble's water supply by an additional 17 million gallons a day, and much more than that was available if the occasion demanded.

Having converged supplies of all three types of water at Baytown, it is time now for an understanding of the cooling system. It is a recirculating system; that is, the water, or most of it, is used over and over again. Prior to 1943, all water in the recirculating system had been well water. The availability

1100-ACRE LAKE WAS BUILT TO IMPOUND TWO BILLION GALLONS OF SAN JACINTO RIVER WATER FOR BAYTOWN PLANTS

of surface water released larger volumes of well water for use as boiler feed, although some ground water continued to be used as cooling system make-up.

Since recirculated water is being used continuously, some intermediate cooling system must be provided to handle water coming hot from condenser equipment. For this purpose, some 20 cooling towers are placed strategically around the Baytown plants, recirculating from 2000 to 60,000 gallons per minute each. An estimated total of 450 million gallons is recirculated daily.

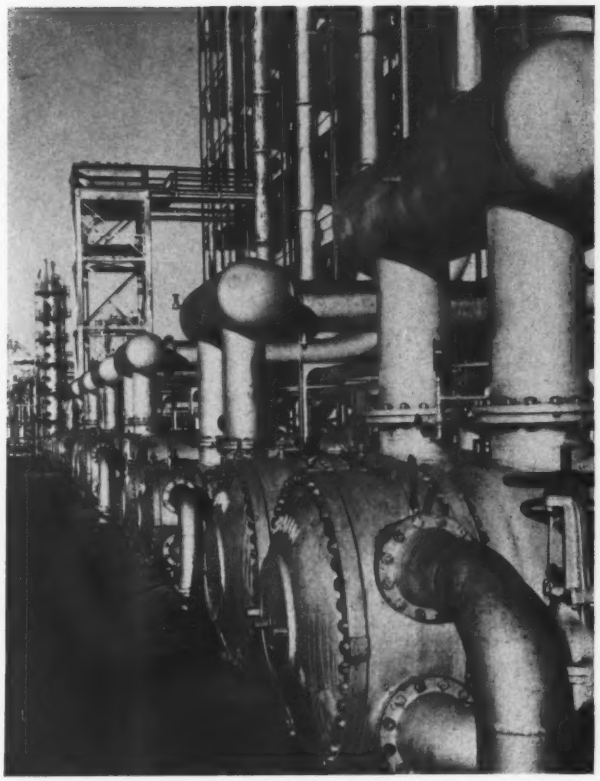
There is a limit, of course, to which cooling towers can do their jobs; they are not refrigerators, in the common conception of the word. Baytown's towers are designed to cool water within five to ten degrees of wet-bulb temperature; that is, the temperature approximated by wrapping a wet cloth around a thermometer bulb and twirling the bulb briskly through the air to hasten evaporation. On days your newspaper reports 100 degrees, for instance, wet bulb temperature will be around 85. Accordingly, water coming on a hot summer day from exchangers at 115 degrees will be cooled to around 85 degrees. This 30-degree spread is quite adequate for refinery cooling purposes.

Once water is cooled and in the pit, it joins the supply pumped continuously to condenser equipment at the operating unit or units served by the tower. Condensers, often called *exchangers* because they exchange heat between oil and water, are valuable pieces of equipment. They are made up of a round, hollow metal shell into which a tube bundle is inserted. A tube bundle consists of hundreds of tiny pipes, each separate from the other but bound together as a unit. When the exchanger is operating, water from the cooling tower is pumped into one end, passes through the maze of tiny pipes, flows out the other end, and is returned to the cooling tower. Hot oil gases from furnaces or steam-heated vessels are introduced at the top of the exchanger shell, contact the cool water-bearing tube bundle, and are condensed at the bottom of the shell. Draw-off lines take condensed oil to other stages of process operations or carry it to storage. While the unit is on stream, condenser operation is continuous, both oil and water constantly entering and leaving the exchanger.

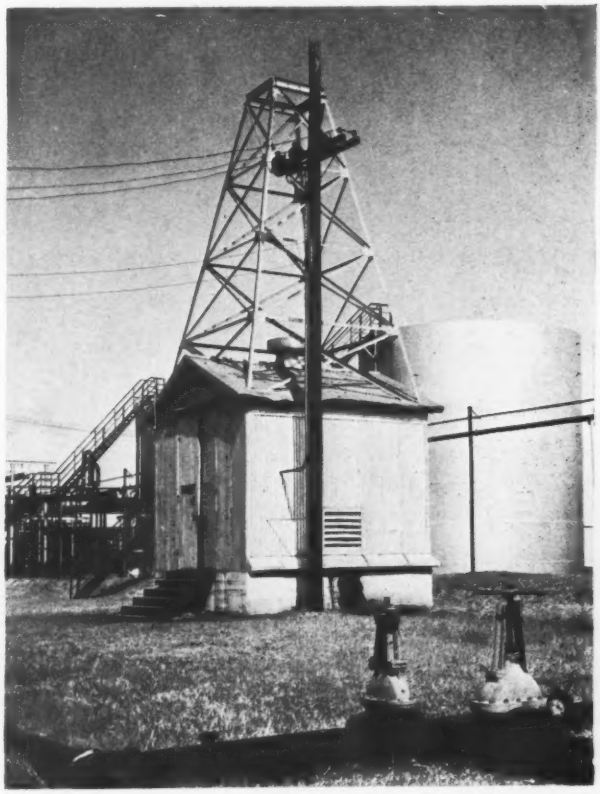
So much for the cooling system. Now for the main function of well water—as boiler feed. Steam is generated at several boiler houses in the refinery and outlying plants. Well water for low pressure steam, say up to 150 pounds per square inch, need not be treated before using, but even well water must be carefully treated before it is converted into high pressure steam (600 pounds per square inch).

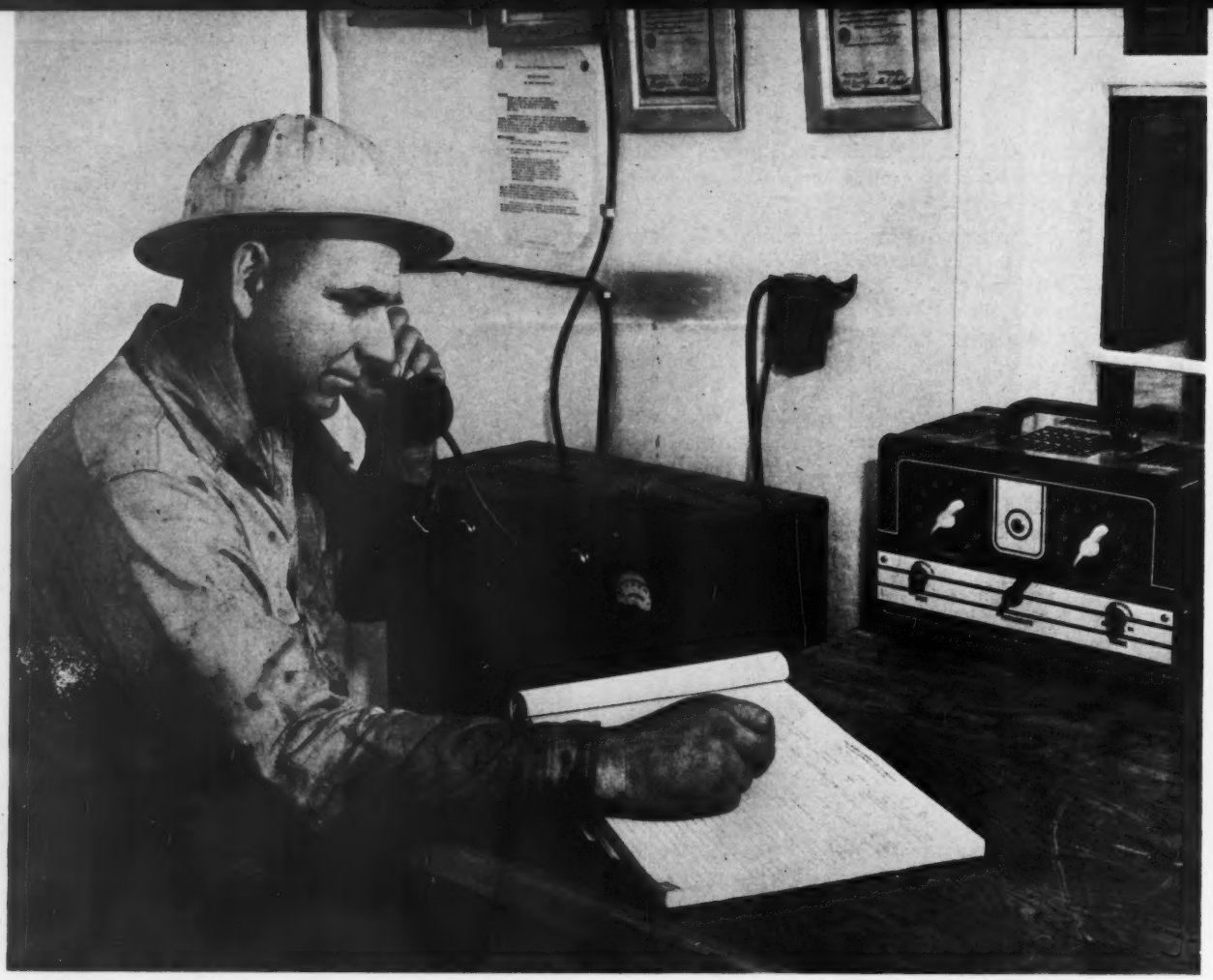
The treating process begins with sulphuric acid to remove bicarbonates which would form scale similar to that in your household teakettle. Then lime is introduced to control alkalinity; next, phosphate is added to reduce hardness nearly to zero; finally, the treated water is filtered to remove traces of sediment or suspended matter. It is now ready to undergo the transition into high pressure steam which is used to generate electric power and to heat oil.

Inspection of the boiler house treating room ends the tour of Baytown's water systems. Tracing the three classes of water from their sources to the refinery, then examining the uses of each class in the field has taken the better part of eight hours. Water no longer seems just water to the visitor; it has become a complex chemical mixture. One fact is unmistakably clear; water is big business at Baytown.



VAPOR LINES curve gracefully down from the tops of distillation towers into heat exchangers where water cools hot gases into liquids. (Below) Eleven water wells now active around Baytown plants produce about 14 million gallons of cool water daily for thirsty refinery units.





DRILLERS ON ISOLATED RIGS HANDLE EMERGENCIES, SPEED DELIVERY OF SERVICE UNITS AND EQUIPMENT BY FM RADIO

Calling District Office

Newly installed short wave radio equipment facilitates communication between Production offices and isolated operations in the field.

THE noisy grinding of the drawworks ceased with a sudden thump. The driller stood erect, took another quick look at his weight indicator, and promptly set his brake. He wiped his forehead, muttered something under his breath, and kicked at a coil of rope as he strode toward the stairway leading down to ground level.

Not a word to the roughnecks on the derrick floor. Their safety hats broke the spotlight beams from above, framing their faces in dark shadows and hiding their knowing expressions. Something was wrong, of that they were sure. But what?

Over in a little hut about 100 feet away the driller sat down and grabbed for the telephone instrument hanging from a rectangular box mounted on the wall.

"KITR, Rig 169 calling KHOI Maringouin." His voice was a little excited. He glanced at his watch and entered the call in the log book. Time: 10:15 p.m. "KITR calling KHOI," he repeated.

The Bayou des Glaise district superintendent at Maringouin tossed his newspaper aside, rose quickly from his chair, and reached for the instrument on his desk. "KHOI Maringouin, superintendent talking," he said. "Go ahead, KITR. What's up?"

"Trouble, chief," the driller's voice announced. "Just twisted off the drill stem. Looks like a tough fishing job ahead. How soon can you get the toolpusher out?"

"Hang on a minute while I make a local 'phone call to see if the midnight crew has left town."

A minute or two later the superintendent was back: "Calling KITR. Are you there, Mac?"

"Go ahead, chief. Catch 'em before they left?"

"Sure did, Mac. Toolpusher will be out with the crew. You need any special equipment?"

"No, I guess not."

"How deep are you, Mac?"

"Just hit 9,785 when she twisted off, chief."

"Well, watch your mud carefully," the superintendent cautioned. "That gas sand's at 9,760, and we don't want a blow-out on our hands, you know. Say look, Mac, I'm coming on out with the gang myself. Get things readied up as much as you can so we can get right on with that fishing job."

"Ok, chief. See you latter."

Normal telephone conversation between a drilling rig and the district office? No, not down in the Bayou des Glaise district in southern Louisiana. The rig from which the driller was talking is out in the flooded Atchafalaya River basin, some 15 miles from the district office, and there are no telephone lines in that area.

It was short wave FM (frequency modulation) radio communication—two-way radio conversation made possible by the new transmitter-receiver sets Humble has recently installed in several districts for emergency and essential communication between district offices and isolated drilling and production operations.

Although the use of FM sets is not yet common in Company circles, permits have been received from the Federal Communications Commission for ten dual sets, and war-tested FM equipment has been installed in six widely scattered districts. Additional applications have been made for use of this equipment, and it is probable that these practical communication units will be used advantageously in Pipe Line Company and in geophysics operations soon, as well as in drilling and producing work.

In addition to the Bayou des Glaise installation, FM sets are now in use in the Bayou Sale, Paradis, and Potash dis-

A TYPICAL ANTENNA installation at the Government Wells district office. Others are mounted on water towers, on lease pumpers, cottages, or on tops of drilling rigs. (Below) District superintendent, chief clerk, and petroleum engineer gather around for a detailed short-wave report.

tricts in southern Louisiana, Government Wells district in Texas, and in the Sunniland district in southwestern Florida. Operators at these points find the equipment helpful and practical.

Practicality of the equipment, however, does not mean that the FCC will grant licenses for any and all industrial purposes. Only when proof of need can be shown are licenses granted, and the prime uses for the equipment continue to be the protection of life and property, and the opening of avenues of communication essential to the drilling for and production of petroleum.

Existing conditions in districts where the equipment is now in use indicate the need for and value of the equipment. The Bayou des Glaise district mentioned earlier is faced with serious transportation problems. From the district office, personnel travel about six miles by automobile, four to five miles by "hand car" rail during the dry season, and five or so additional miles by boat. During the flood season of winter and spring, the little rail system is under water and the boat trip is considerably longer.

In the Paradis district one drilling rig and houseboat for personnel are located in the Delta Farms field, some 30 miles by water from the district office, making the type of communication FM radio supplies very essential to safe and efficient operation. In the Potash district in Louisiana and in the Sunniland district in Florida, long distances separate drilling operations from district offices, and in both districts the best transportation is extremely slow.

Located 20 miles from the nearest telephone and 35 miles from the Government Wells district office is a drilling rig on the Watkins-Withers wildcat well on the Webb-LaSalle county line in the ranch country of southwest Texas. To add to the acute isolation of this rig, roads become impassable for several days after a rain. Here is an example of maximum need and maximum usefulness of this comparatively new method of communication for industrial use.

While frequency modulation radio communication is new in Humble operations and in oil operations generally, it is not something new in the field of radio. It was developed before the war and had been in use extensively by law enforcement agencies for contact between central offices and patrol cars. Widespread use of FM radio by the armed forces brought about improvements in equipment to a point where its dependability invites many feasable applications in industry.

The method of operation and the advantages of frequency modulation over ordinary amplitude modulation may be explained something like this: Frequency modulation equipment of the type employed by Humble are 50 watt transmitters designed for short distance communication and operating on high frequencies. In fact, the frequencies are so high that the radio wave takes on a characteristic of a light beam, following almost the line of sight. Therefore, the distance of transmission on these authorized frequencies is governed more by the height of the antenna and the terrain than by the power of the transmitter. For example, if a beam of light is to be cast for a considerable distance and there are obstructions such as a hill or a structure between the source of light and the desired goal, adding power to the light adds little or no advantage. But raising the height of the source of light would help materially in casting the beam over obstructions. In the same manner, the height of the antenna and the lack of high interfering objects controls the distance at which FM radio communication is practical.

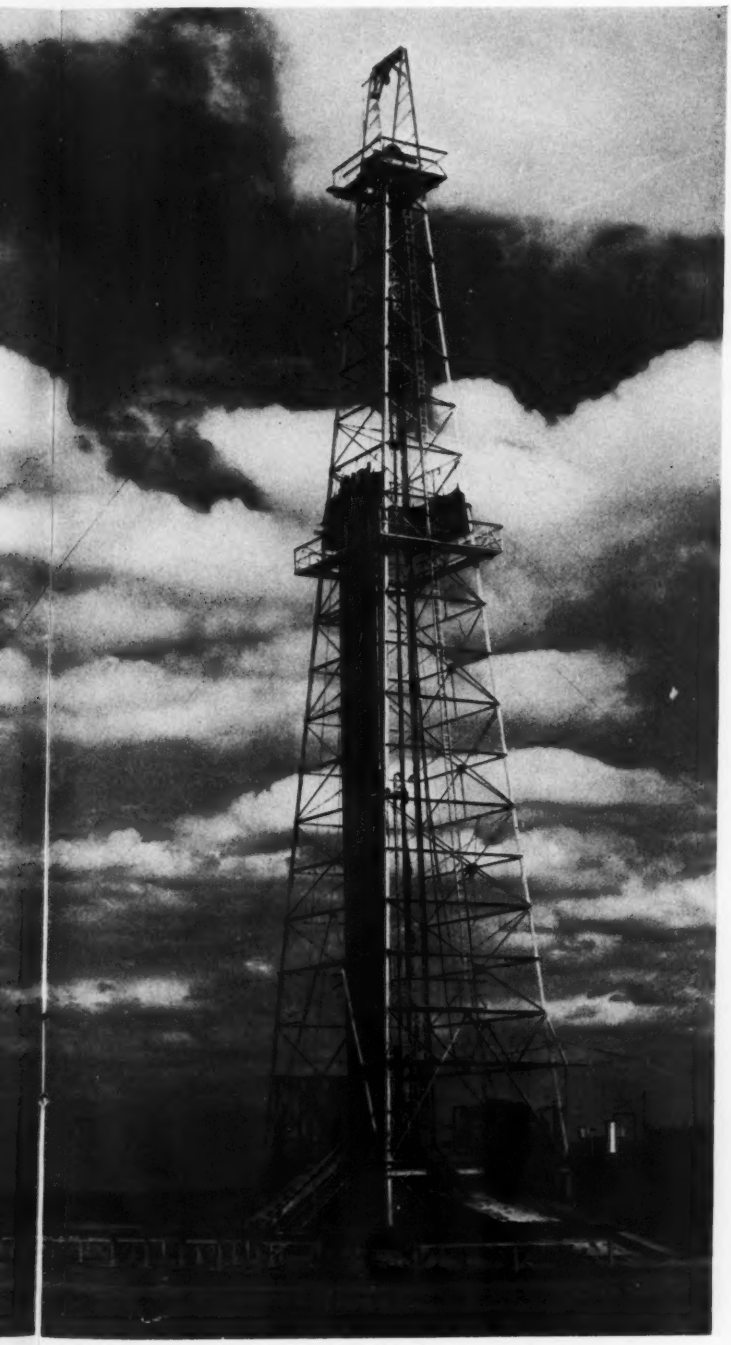
Since, however, antenna more than 150 feet high must be lighted for the protection of aircraft, all Humble installations range from 65 to 150 feet in height. Some are mounted on the tops of drilling rigs; others are projected above water towers in district housing sections; still others are mounted on pumper's cottages in the field.

Virtually all equipment is operating in the flat Gulf Coast plains, and little difficulty is encountered in obtaining full maximum range expectancy. The three types of service now in use or contemplated for future use are: the fixed station

TWENTY MILES FROM NEAREST TELEPHONE, GOVERNMENT WELLS , DIS

like those used in district offices and in pumpers' cottages out on remote leases; the second is the portable-mobile station mounted on a drilling rig. This type is stationary on the rig but will move from place to place and cannot transmit while in transit. The third type is the mobile unit for use on barges, boats, trucks, and similar vehicles. Such a unit requires a mobile license and may transmit and receive while in transit. Obviously, the antenna on a mobile unit cannot be at such great heights as on the fixed or portable-mobile units, thus reducing its transmission range.

ELLS . DISTRICT WILDCAT FINDS SHORT WAVE RADIO VERY USEFUL



Actual operation of the various FM units is comparatively simple. Receivers at all points are "on" at all times so that any one of the several transmitting stations may call a desired station. Transmitters are turned on only when an operator desires to communicate with another FM equipped point. This is accomplished by pressing a small button on the telephone hand set.

A limited number of employees are licensed as operators in each area where sets have been installed. In most instances the district superintendent, the tool pusher, and the chief clerk are licensed in the district office, with the drillers and one other person out on the rig, or a pumper out in the field being licensed at the other end. To be licensed, an employee must pass a simple FCC examination which demands primarily a knowledge of the laws and rules governing radio communication; it does not require technical knowledge of the equipment, nor does the granting of a license permit the holder to perform repair work or make adjustments. All licensed operators are held strictly responsible for intelligence transmitted, and under normal conditions a licensed operator either must be actually transmitting or he must be standing by so that he may know what is being transmitted. Only in real emergencies may non-licensed employees transmit.

The recent installation of FM radio units in Company operations areas does not mark the first use of radio by Humble between district offices and isolated operations. As early as 1937, Humble made application to FCC for license to operate radio-telephone equipment on frequencies normally reserved for ship-to-ship communication. These facilities were designed to make possible radio contact between an isolated rig and the district office. Later licenses were obtained for communication with coastal harbor stations and thence by commercial telephone line to anywhere on their system. The first of these units was placed in operation on Barge Rig 170 in Galveston Bay in April, 1940, and even with the introduction of FM radio sets the Company still has in use seven of these radio-telephone sets—four in Texas and three in Louisiana. While these older units continue to serve some purposes adequately, they function under two distinct disadvantages; greater static interference than in the newer FM units; and the problem of delays in obtaining connections through to commercial land telephones. One advantage of the older equipment is that it has less range limitations, because once connected with a coastal harbor station the isolated unit can communicate with any point having commercial telephone service.

Since there is a limit to the number of frequency channels available in the frequency spectrum, the FCC can license only a limited number of stations. Currently there is being conducted by the Radio Technical Planning Board an exhaustive study of the entire radio frequency field, and all frequencies being licensed by the FCC are on a temporary basis, subject to change if a complete re-allocation of frequencies seems advisable and is made in the future.

Average range expectancy of these FM units is about 65 miles and their prime purpose is for communication between points within a district. Experience has shown, however, that they are proving extremely valuable for inter-district communication also.

The *plus* utility, over and above the intra-district service, has made the radio units very useful. They are comparatively economical; they are simple to operate and maintain; and they provide static-free communication at any time.

The FRIENDLY Border

Significant *fiestas* at Laredo and Brownsville stimulate neighborliness on both sides of the Rio Grande

Annual celebrations which abound in historical significance and human interest are held in many localities in Texas. Two such ceremonies staged early each year are the Washington's Birthday celebration at Laredo and the Charro Days fiesta at Brownsville. While the two differ somewhat in historical background, the pattern of Latin-American cooperation and friendship is similar. Since they were held only a week apart this year, and since they are much alike in flavor and atmosphere, we have combined the report of the two in a single article which should be of interest to our readers.—EDITOR.

ON A BUNTING draped platform in the center of the International Bridge which spans the lazy Rio Grande between Laredo, Texas, and its Mexican neighbor, Nuevo Laredo, stood a group of top military men of the United States and Mexico. Taller by a head than any of his companions, the muscles of his lean jaw set in solid lines, General Jonathan M. Wainwright listened attentively as his chief-of-staff translated into flowing Spanish the citation by which the Congress of the United States awarded posthumously to Manuel Perez, Jr., of Nuevo Laredo the Congressional Medal of Honor. Behind the general, dry eyed, tense with emotion, stood Senor Perez, Sr. At the conclusion of the citation he stepped forward to receive from the general's hand the plush box encasing our nation's highest award for gallantry beyond the call of duty.

Massed on the south side of the international boundary, a military band began the Mexican national anthem, cutting short the cheers of the crowd around the speakers' stand. As the last strains of this stirring melody floated away an army band on the north side of the boundary struck up *The Star Spangled Banner* and all eyes turned northward. Thus began the third day of the forty-ninth annual celebration of one of the most historic observances in the United States. Since 1898, Laredo, a municipality for more than two hundred years, has celebrated with pomp and ceremony the birthday of George Washington.

The history of this Washington's Birthday observance seems prophetic of the present day move toward better Latin-American relations. Almost from its very beginning this celebration, which honors a great patriot of the United States, has been welcomed by our neighbors south of the border who revere their own Hidalgo, Juarez, and Bolivar. Their early celebrations of *Cinco de Mayo* commemorating the Mexican victory over the French invaders and their *Diez y seis de Septiembre* in honor of the declaration of independence of Mexico against old Spain, were observed in old Laredo which even today is composed of people who are 75 per cent of Latin origin and 25 per cent of Anglo-Saxon ancestry.

The first distinctly American celebration in Laredo was held on July 4, 1869, when the people indulged in horse racing, sack races, and catching greased pigs to celebrate the anniversary of the declaration of independence of the United States.

The first Washington's Birthday celebration was in 1870 when a program was arranged which featured horse-racing and a goat roping contest. Strangely enough it remained for a fraternal organization to inaugurate on the broad scale which it now enjoys, the Washington's Birthday celebration at Laredo. This organization, known as the Red Men, planned, executed, and brought to successful culmination the 1898 ceremony and from that day the celebration has been an annual affair.

GENERAL JONATHAN M. WAINWRIGHT, representing the President of the United States, makes posthumous presentation of the Congressional Medal of Honor to Manual Perez, Jr., of Nuevo Laredo. Standing with the General is Marcario Garcia, Medal of Honor winner, and behind him are military and state officials from the United States and Mexico.

For twenty-five years the Red Men carried on alone but by 1923 the ceremony had grown to such proportions that an association composed of the leading business men of Laredo was formed and chartered to sponsor the celebration. They have continued and expanded the Laredo fiesta and in 1939, to assist the central organization and make available the wide talents of the ladies of Laredo, the society of Martha Washington was organized. Each year, from the membership of this organization, the first lady of the celebration, Martha Washington, is chosen. The organization also elects her escort who, for the period of the fiesta, impersonates George Washingotn and presides at all functions.

The 1946 Washington's Birthday celebration consisted of five days of fun, frolic, and ceremony during which time the Rio Grande ceased to be thought of as a boundary between two countries and became a slow moving river across which hands were joined in good fellowship and understanding.

At seven o'clock the morning of Wednesday, February 20, a 21-gun salute from Fort Macintosh announced the official opening of the celebration. During the day, as last minute finishing touches were put to the gay street decorations, as

merchants made ready to close their doors for the balance of the week, bands began playing in the plaza. Late in the afternoon the airplane bearing General Wainwright, guest of honor for the celebration, arrived at Laredo airport. Thousands lined the streets to cheer the famed hero of Bataan as he and his staff were whisked to the first of the many events in which he participated.

At early dusk, following the precedent of the first celebration, the city was officially illuminated in colored lights. In the plaza, at the city hall, on the main streets of Laredo and miles out the broad highway leading into Laredo from the north, the lights, the bunting, the spirit of fiesta welcomed the thousands of visitors flooding in. At eight o'clock, in a colorful ceremony, *Miss Laredo*, the young lady who represented the city at all official functions during the celebration, was presented, with her court of Rio Grande belles, to the people of Laredo.

On the next day in a splendid gesture of international amity, General Wainwright was honor guest at a luncheon in Nuevo Laredo attended by high military and political leaders of the two nations. The group, limited to 30 guests, included besides General Wainwright, two generals of the Mexican army, two generals of the army of the United States, the governor of Texas, three governors of Mexican states, the consul general, the attorney general of Texas, and the mayors of Laredo and Nuevo Laredo.

In the evening, the general, his party and visiting dignitaries were guests of honor at the Colonial Victory Ball and pageant where were presented George and Martha Washington, patrons of the celebration. On a stage, spangled and glittering with the replica of the original flag of the United States, George and Martha Washington received the representatives of the original thirteen colonies, the beautiful Rio Grande belles attired in hoop skirts and ruffles accompanied by their bewigged escorts.

On the morning of February 22, following the ceremonies on the International Bridge, General Wainwright and his group proceeded to the main plaza of Laredo and to the reviewing stand in front of the Federal Building. Here, in keeping with precedent, the keys of the city were surrendered to Miss Pocohantas and her mounted Indian escort. This was the signal to begin the forty-ninth annual grand parade for which men, women and children from both sides of the river had been waiting since early morning.

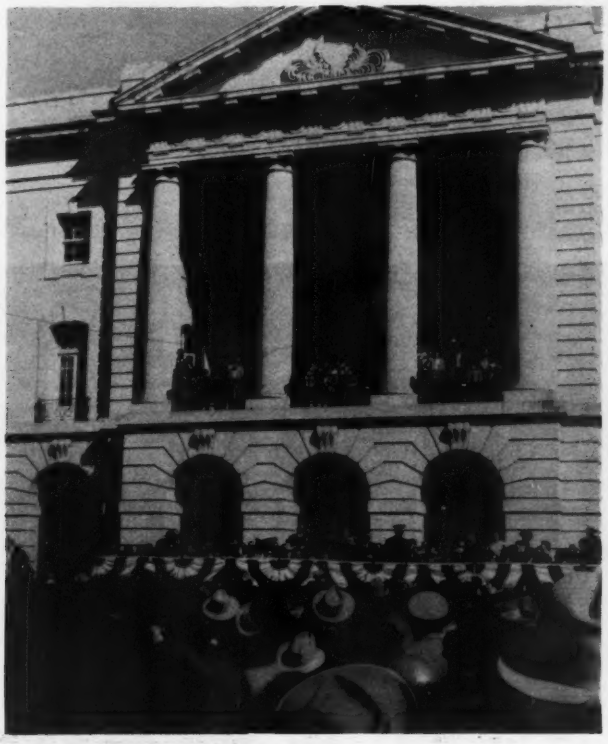
At the head of the parade on a prancing Palamino, sitting lightly in a handsome silver encrusted saddle and dressed in chaps, colorful shirt and wide brimmed hat, rode the Grand Marshal. Following him came a drum and bugle corps from the Mexican army and behind them with fixed bayonets, full packs and measured stride, a crack contingent of Mexican troops.

Then came units from the army and navy of the United States, bands, marching men, mechanized equipment and more bands and marching groups from schools on both sides of the river. Prancing drum majorettes led smartly stepping school bands, Mexican gymnastic units swung Indian clubs and dumb bells; a huge Mexican flag was carried by hundreds of young girls. Then came the floats; gay, airy, colorful floats in which rode the lovely Rio Grande belles dressed in appropriate costumes.

For more than an hour the parade stretched out and then a cheer went up from the crowd as a huge mobile nosegay on which sat George and Martha Washington came into view.

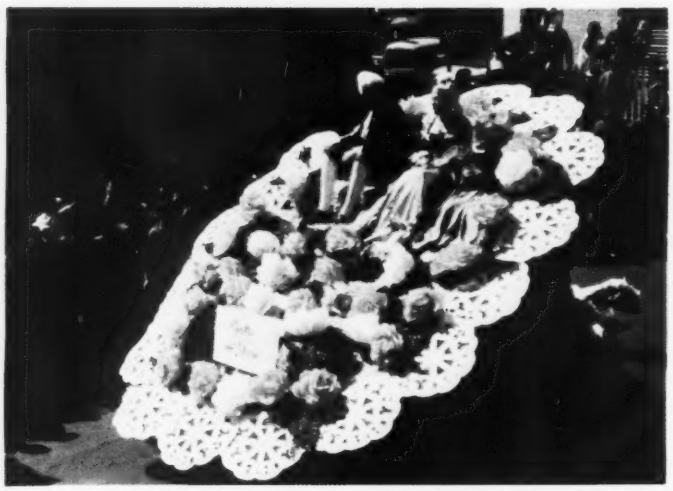
Continued on page 16

CEREMONIES PRECEDING the Washington's Birthday parade centered around the reviewing stand in front of the Federal Building.



GUESTS OF HONOR at the Colonial Victory Ball were Governor Coke Stevenson of Texas, *Miss Laredo*, and General Wainwright.

SOME OF THE COLOR of the celebrations at Laredo and Brownsville has been captured in the pictures on these pages. In clock-wise fashion on this page are: The Rio Grande Belles add life to one of the decorated floats in the Laredo parade; General Wainwright is serenaded by a Mexican entertainer at the *Fiesta en la Plaza* in Brownsville; George and Martha Washington greet the Laredo crowds from their mobile nosegay; Miss Laredo and her attendants ride in splendor; a live bouquet waits for the Children's Parade in Brownsville.



IN COUNTER CLOCK-WISE fashion on this page are: striking mother-daughter costume combinations brightened the crowds at Brownsville's Charro Days; the lovely judges of the Charro Days Brush Court examine the beard of one of the contestants; dressed in authentic costumes, these children are some of the 10,000 who took part in the Charro Days Children's Parade; strolling musicians were part of the daily scene at Charro Days; a Mexican mother and her children pose before an old fountain in Brownsville.

THE SHINING METAL sheath of an Airliner forms a modern background for the colorful costumes of a lovely *China* and her *Charro*.

Continued from page 13

After this came other marching groups, bands, floats, until at the very end of the parade, unofficial perhaps, but poignantly descriptive of the spirit behind this celebration, came a small truck. Standing on the bed of this truck, his black hat in his hand, his gray locks tumbled by the breeze, was a venerable gentleman of Mexican ancestry, surrounded by more than twenty children and young people of varying ages, patently his grandchildren. Behind him, decorated with colored crepe paper and gay pictures, was a crudely lettered sign in English and Spanish. The English version read, "Viva America, my adoptive country."

After the parade the crowd dispersed to the various activities planned for the afternoon. There was a barbecue, a rodeo, a merienda for the wives of distinguished guests, and at four o'clock in the *Plaza de Toros* in Nuevo Laredo a bull fight. At 7:30 in the evening, keeping alive another of the precedents established by the first celebration, a gigantic fireworks display ended in the traditional portrait in colored fire of George Washington.

Fun and revelry continued at Noche Mexicana, around the plaza where bands played continuously, and at the gay carnival grounds. On Saturday at six in the afternoon, the Mexican village was opened at St. Augustine plaza where the typical costumes, customs and entertainment of old Mexico held sway. On Sunday, again following the tradition of the first celebration, special services were held in the churches of Laredo and that evening a religious parade to the Federal building where outdoor patriotic services were held, brought to a formal conclusion the forty-ninth annual Washington's Birthday celebration.

When Laredo was writing finis to its celebration, two hundred miles south, at the mouth of the Rio Grande, another Pan-American celebration was just beginning. Brownsville's famed *Charro Days* was being opened to the accompaniment of music, dancing, colorful costumes, and general gayety at Baile del Sol. This preview to the costumes and entertainment to be offered the latter part of the week, was being held in the patio of the El Jardin Hotel, focal point of earlier day Charro Days celebrations.

Charro Days has neither the background nor seriousness of Laredo's celebration honoring George Washington; instead it offers color, variety, and fun. Inaugurated only nine years ago as the idea of Kenneth Faxon, a Brownsville attorney, it has a short, although sometimes hectic history. The basic idea of colorful Spanish costumes, authentic atmosphere, and crowd participation has caught the public's fancy and support.

As in Laredo, the Brownsville celebration is a wonderful example of Pan-American cooperation of the highest order. The name of the celebration is distinctly Mexican, *Charro* meaning a gayly dressed horseman, and the men's costumes are authentic replicas of Charro outfits worn for years in Mexico. The ladies' costumes are also just as distinctly authentic, much research being done into the background of any costume. Unless the costume is of a design that has been in use for fifty years or more, it is not considered appropriate for Charro Days.

The entertainment during the festivities is distinctly Mexican and in the parades which mark the high spots of the ceremony, both sides of the Rio Grande participate.

Crowd participation at Charro Days is not a passive affair. For months the ladies of Brownsville and her sister city across the Rio Grande, Matamoras, are busy planning, designing, making or procuring the costumes for themselves, their children and their husbands. These costumes vary from the elaborate festival garment La China Poblana for the ladies, and El Charro for the men down through less elaborate traditional costumes to the native *Tipica* costumes. And the elaborateness of the festival raiment bears little connection with the wearer's financial standing because during Charro Days all people celebrate and the tight trousered, silver bedecked dandy may be a clerk at a corner store, while the leading banker may be attired in the loose fitting pajama-like costume of the Mexican peon.

All men in Brownsville, however, have one thing in common, a beard. Right after the first of the year, the male population throws away its razors and for the next two months, each man to his own ability, raises, tends and cultivates a growth of whiskers. To be a native of Brownsville and be without whiskers during Charro Days is not only unthinkable but unhealthy, for during the festivities, the Brush Court holds continuous session and levies punishment upon the smooth faced offenders.

While much of the charm of Charro Days lies in its spontaneity, a great deal of planning went into the program of the 1946 fiesta. In the three or four days following Baile del Sol, streets were being decorated, the Mexican village at the foot of International Bridge was being put in readi-

ness, the merchants were completing their special window displays, and the general populace was getting in the mood for fun. By Wednesday evening preceding the formal opening all was in readiness, and to add stature to the celebration, and forge even closer the neighborly bond established at Laredo the previous week, General Jonathan Wainwright arrived by plane at the Rio Grande International airport. It was in the nature of a homecoming for General Wainwright who thirty years ago, then a second lieutenant fresh from West Point, was stationed at Fort Brown.

At ten o'clock Thursday morning, February 28, street music and entertainment began all over Brownsville and the Charro Days celebration was underway. Costumed crowds thronged the streets; *mariaches*, wandering bands of musicians, gave impromptu serenades on street corners; singers and dancers performed; swaggering Charros and shuffling peons rubbed elbows; the streets were roped off; the Brush Court was in session.

Shortly after noon the crowds began to throng the line of march of the grand parade and at 2:30 from the gates of Fort Brown came the open car containing General Wainwright. He traversed the complete line of march and then mounted the reviewing stand. For more than an hour, the mile long procession of military units, marching people, colorful floats, and costumed horsemen passed between the crowded banks of spectators whose costumes were almost as gay as those of the paraders.

After the parade the formal program included quarter horse racing at the Charro track, and band concerts at the main reviewing stand; but again the chief interest, the chief color, and the center of festivities was in the roped off streets of downtown Brownsville where the crowds continued to wander.

That evening the "Fiesta en la Plaza" opened in a gayly decorated auditorium at Fort Brown. Authentic Mexican food, talented entertainers, and the bright costumes of the patrons were the attractions. Here General Wainwright was entertained at dinner, was serenaded by a wandering troubador, and then accompanied by his staff, proceeded to another large hall within the walls of Fort Brown and there opened the first Grand Charro Ball. Music of a famous Mexican band, the light laughter and spontaneous gayety of the colorful crowd were a far cry from the privation and hardship the general knew so well less than a year ago.

FLOWING BEARDS are standard equipment during Charro Days. After the judging a Brush Court official (center) awards decorated mustache cups to the Whisker Champion (right) and to Little Fuzz.

Chief attraction of the second day of Charro Days was the children's parade. By noon the paraders had begun to gather, more than 1,000 school children of Matamoras had crossed the International Bridge to take part in the parade. They were joined by Brownsville school children and when parade time came, more than 10,000 were in the line of march.

Brilliantly costumed, excellently drilled, and shepherded by anxious teachers, the children provided what was to most spectators the outstanding spectacle of the entire celebration. Leading the parade was a group of girls from Matamoras who performed their Mexican folk dances over the whole route of the parade. Following them were strolling singers, miniature replicas of the familiar street vendors, elaborately costumed Chinaettes, boy drawn floats, and every conceivable variety of activity and attire appropriate to the occasion. At the end of the parade many of the children were dusty, tired and carrying their shoes in their hands, but had taken part in one of the most colorful processions most of the spectators had ever seen.

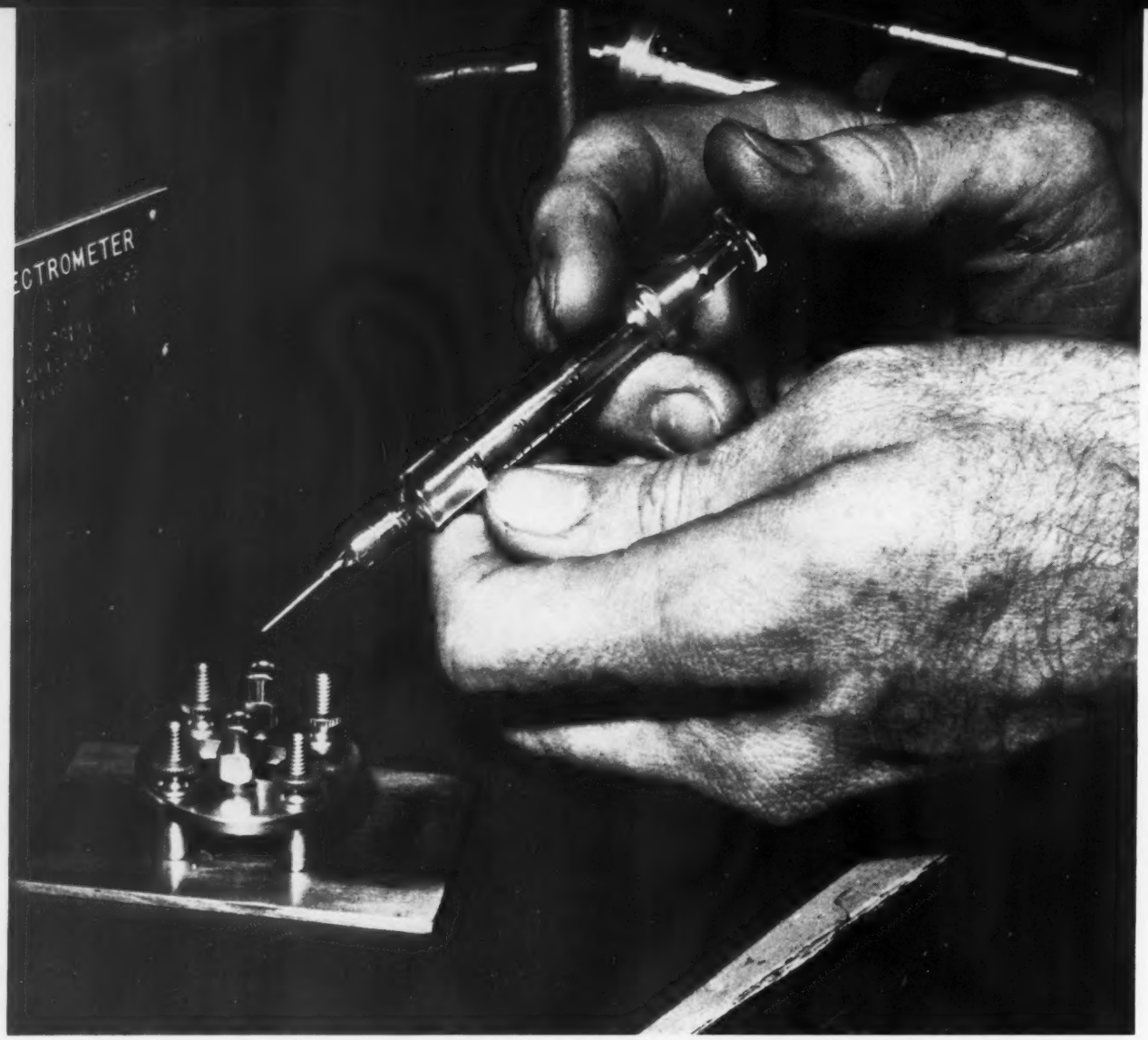
The entertainment on the evening of the second day consisted of a presentation of *Asi es Mexico*, a pageant on Mexican life, *Fiesta en la Plaza*, and the second Grand Charro Ball.

Saturday's features were many. At one o'clock in the afternoon came the Grand Charro Roundup of Chinas and Charros on horseback. Here were the most glamorous of all costumes, gaily caparisoned horses, lovely lady riders modestly riding sidesaddle, and dashing Charros. After the best costumed China and Charro had been selected, the horsemen, not content to abandon the rising tide of gayety, rode the streets, every now and then emitting a shrill *grito* and lassoing Chinas.

At two o'clock came the beard judging contest, in which, after elimination, some twenty of the wearers of outstanding facial adornment were judged by a jury composed of charming young Chinas. They were directed by the "chief injustice" of the Brush Court to notice particularly the texture, neatness, and abundance of growth sported by the various contestants. After due deliberation, a grand champion and a "little fuzz" were chosen.

Other entertainment events of the afternoon were motor boat races at Port Brownsville, band concerts and general merrymaking in the streets. At eight o'clock came the Grand Charro Parade with thousands of marchers, colorful floats, the spluttering red fire traditional to torchlight parades, the swinging varicolored lights of the street decorations and the ever present closely crowded ranks of vividly dressed spectators.

At ten o'clock as the final Charro Ball swung into fast tempo at the auditorium in Fort Brown, the bands also struck up their gay tunes in the streets of Brownsville and the gala street dance, free to all comers, began. Here the gayety of the celebration reached its height. Here the spinning dancers from both sides of the Rio Grande forgot their troubles, met in a common love for entertainment. Under the arching sky spanning the Rio Grande from Laredo to Brownsville, good neighbors became good friends.



SAMPLES OF OIL REQUIRED FOR MODERN LABORATORY ANALYSES HAVE BEEN REDUCED FROM GALLONS TO DROPS

Fingerprinting OILS

FOR CENTURIES, men searched in vain for some uniform and infallible method of establishing personal identity. Each proposal was explored and rejected until, in our own time, an answer was found right on the searchers' fingertips. The learned gentlemen discovered, to their astonishment and delight, that the tiny arches, loops, and whorls in their fingerprints were different from those of any other person. Although prints are grouped into similar general patterns, no two persons have exactly the same prints. Oddly enough—and this made it perfect—tests proved that fingerprints remain unchanged from cradle to grave.

In industry, too, men of science searched diligently for surer, faster methods of determining the identity of unknown compounds. The quest was not only for faster and more accurate means of identification, but also for ways to identify those materials which previously had resisted all known means of analysis.

New physical instruments speed up analyses of oils and compounds

In the last five years, physicists have successfully combined their knowledge of electronics and spectroscopy (that branch of physics which deals with the innermost properties of molecules) to develop and perfect instruments which, in effect, take an unknown sample's composite fingerprint. These new processes have unlocked doors long closed to the petroleum and chemical industries, in whose laboratories it is now possible to analyze oils and many other complex chemicals in a fraction of the time formerly required. More than that, it has literally brought to light several ways of analyzing compounds previously untouchable by any method. Myriad combinations of hydrogen and carbon making up

crude petroleum and its components may be sorted out and identified as quickly and accurately as a stranger is identified by his fingerprints. Indeed, since the character and identity of the mixture under analysis are established through markings made on photographic film by a recording device, the fingerprinting analogy is singularly appropriate.

Although similar in certain general respects, these spectroscopic and electronic instruments vary widely in design and application. *Absorption spectrometers*, for instance, analyze certain oils by the amount of ultraviolet or infrared light they absorb. Unabsorbed light, passing on through the sample, is measured and recorded in terms of transmitted energy. The amount of energy absorbed and the wave length at which it is absorbed determine the sample's composition. If the sample is a mixture of compounds, each will be identified by the position at which its absorption curve appears on a chart record. From the peaks and valleys drawn by the measuring instrument on this paper chart, operators may also determine the concentration, as well as the identity, of each type of oil in the mixture.

Another instrument, called the *mass spectrometer*, includes an electron gun which shoots negative electrical charges away from the molecules in a gas sample, leaving them with excess of positive charge. These positively charged masses are set in motion and move in curves of varying radii, the radius of curvature depending on the weight of each mass. The spectra of these masses are scanned, one at a time, across a receiving device which measures the amount of electrical current in each mass group. The different gases represented by these mixture spectra are thus distinguished by the amount of current recorded by the instrument at definite positions on a chart roll of photographic paper.

Still another instrument, the *emission spectrograph*, is used to determine elements present in a mixture by exposing a photographic film to the sample's light spectrum when the sample is burned at 5000 degrees Centigrade in an electric arc. By comparison with a master film, the elemental composition of the sample may be determined.

At Humble's Baytown refinery, these and many other related instruments have been brought together in a new air-conditioned Physical Measurements Laboratory. The machines themselves resemble hybrid crosses between a modern radio station and something from a fantastic Jules Verne novel. Besides those already mentioned, there are others bearing such awesome names as *polarographs*, *flame photometers*, and *X-ray analyzers*. They are complicated in design, but are surprisingly easy to operate.

Before any attempt is made to discuss these instruments in detail, let us review some elementary physics.

Everyone is familiar with the gaily-colored *spectrum* in a rainbow as sunlight is dispersed, or bent and separated, by passing through water particles. The rainbow's beautiful colors are caused by different *wave lengths* of light. But there is more to this spectrum than meets the eye; not all light waves are visible in the rainbow. Infrared waves, for instance, are too long to be seen by the human eye; ultraviolet waves too short. It is on these invisible waves that many spectroscopic instruments depend for their operation.

Take the *infrared spectrometer*, for example. Source of light for this instrument is a glowing carborundum rod, electrically heated to 1000 degrees, at which temperature the rod emits light rich in infrared waves. The extent to which samples of unknown oils absorb this light determines their composition.

Only one-fifth of a cubic centimeter of oil—about two drops from a household medicine dropper—is required to make an analysis with the infrared spectrometer. So small is the sample that it must be injected with a hypodermic needle. The cell, or sample holder, consists of two plates of compressed and polished rock salt with barely enough opening between to hold the sample.

When the cell is filled and in position, light from the carborundum rod is directed through the sample. Obeying spectroscopic laws, the sample absorbs some of the light and allows the rest to pass on through to an arrangement of rock salt prisms and polished mirrors whose purpose is

ABSORPTION SPECTROMETERS ANALYZE COMPOUNDS BY THE AMOUNT OF ULTRAVIOLET OR INFRARED LIGHT THEY ABSORB

to sift out and purify the infrared light. Different wave lengths can be selected by changing the position of the mirrors and prisms.

The sifted and purified light is allowed to shine on a thermopile, or highly sensitive device for measuring heat (infrared light, of course, contains heat energy). The impulse from this thermopile, translating heat into electrical energy, is directed to a galvanometer. This is a device so delicately balanced that the slightest electrical impulse will unbalance it, causing it to swing to one side or the other. The extent to which the galvanometer is unbalanced is detected by a photoelectric cell, or so-called "electric eye," which relays the amount of energy causing the deflection to an amplifying system. Magnified some 33,000 times by the amplifying mechanism, electrical energy which originated at the thermopile is now measurable in millivolts (1000 millivolts to a volt) and is recorded on the paper chart of a temperature instrument. From positions of lines drawn on this chart, it is possible to identify the material or materials in the unknown sample.

The *ultraviolet spectrometer* acts on exactly the same principle as the infrared, except that it uses wave lengths below, instead of above, the range of vision. Ultraviolet light source is a hydrogen discharge tube; quartz, instead of rock salt, is used in prisms and cells. Both instruments must be calibrated, or pre-checked, on pure compounds before analyses can be run on unknowns, and a "blank determination" is taken before each analysis, making use of a nonabsorbing substance which will "zero" the instrument.

Now to the *mass spectrometer*.

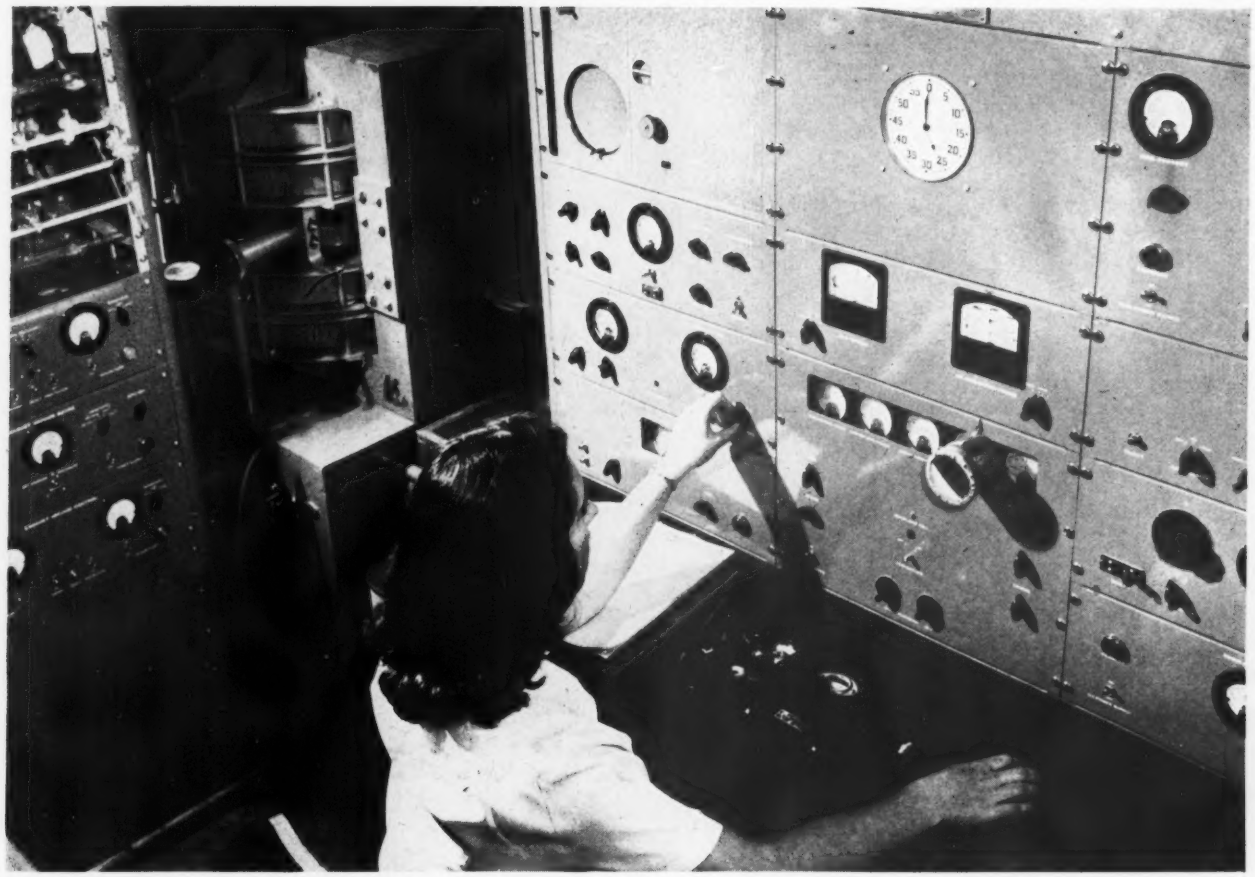
This, strictly speaking, is an electrical and electronic instrument. It operates on gases, rather than liquids or solids. So precise is the mass spectrometer that it deals in molecules, or molecular masses. A thimbleful of gas at atmospheric pressure provides enough sample for ten analyzes. Gas samples are put under high vacuum and passed continuously to an *ionization chamber* where molecules of the gas are bombarded with low speed electrons. This electron artillery knocks off negative electrical charges from each molecule, leaving it positively charged.

The masses are formed in an electrostatic field and are set into motion immediately; movement thus far is in a straight line. Next, they are passed transversely through an electromagnetic field, which separates the different masses according to weight and changes their motion from a straight line to a curve. The lighter masses travel in short-radii curves; heavier masses have travel curvatures with longer radii.

Since only one mass can be measured at a time, the various masses in the spectra are scanned across a narrow slit, one at a time, by changing the voltage of the electrostatic field. As each group of masses crosses the slit, the positive charge is caught on a collector plate, thus giving a definite amount of electrical current. Currents caused by impingement of the electrical charges of the various masses on the collector plate are amplified about 1000 times and sent to a galvanometer and recording device. Variations in current are recorded as hills and valleys on the sheet of photographic paper in the recorder. The positions at which hills appear identify hydrocarbons of particular mass weight; height of each peak establishes the concentration of those masses in the gas mixture. Since several compounds may produce the same mass, it is necessary to separate several masses in order to identify two or three compounds of the same original weight.

That brings us up to the *emission spectrograph*.

ELECTRONIC AND spectroscopic instruments are kept in good order by specially trained instrument men. Here, a maintenance expert takes the pulse of an ailing mass spectrometer. (Right) The emission spectrograph literally takes the pictures of elements burning in an electric arc.



TRAINED PHYSICISTS CONTROL MASS SPECTROMETER OPERATIONS WITH THE DIALS AND SWITCHES ON THIS PANEL BOARD

The emission spectrograph is designed to detect the presence and measure the concentration of elements, rather than compounds, in solids and solutions. Operation of the instrument depends upon the light-emitting characteristics of elements in the test specimen when it is placed in a high-temperature arc.

Light from the arc passes through a narrow slit to a diffraction grating and is returned from there to a photographic film. An image of the slit occurs on the film at each wave length for which light is produced in the source. After development, the film is placed in a densitometer in which there is a master plate containing characteristic lines of all the elements. The film of the unknown substance is projected on a screen alongside the master film for comparison. The positions of the various lines and their comparative densities indicate various elements in the sample. Densities, read directly from an ammeter in a phototube amplifier circuit, indicate the relative amounts of those elements in the mixture. The instrument is equipped for photographing emission spectra in both the visible and ultraviolet wave length ranges.

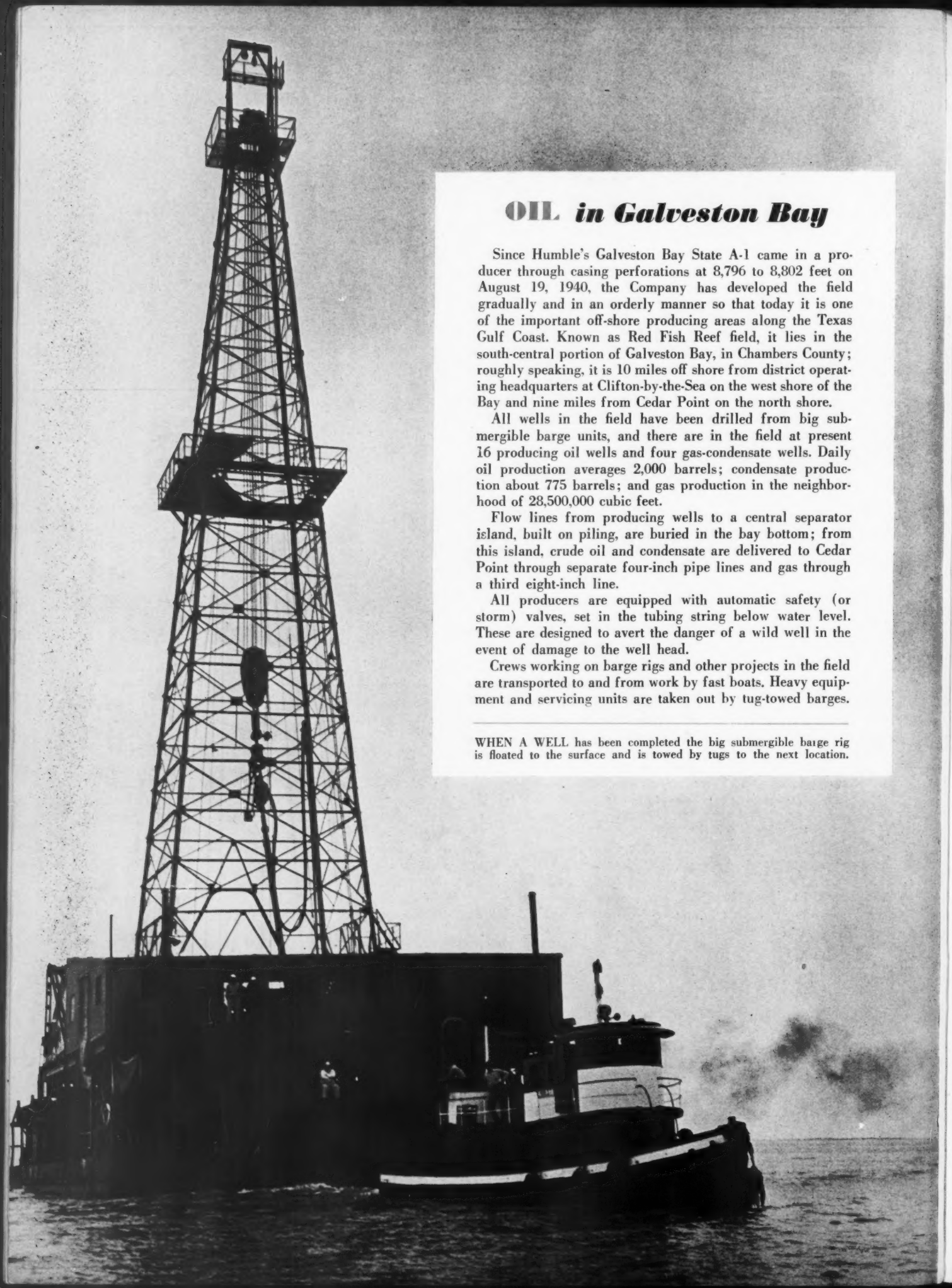
So much for the operation of these instruments. What about their past, present, and possible future uses?

A great many advantages have already been derived from their applications at Baytown. An ultraviolet spectrimeter installed on the feed line at the Butyl rubber plant keeps a running record of the percent isoprene in the feed stream. The accuracy of this work can be imagined when it is pointed out that isoprene concentration must be controlled at *one-half of one percent.* Other spectroscopic instruments had distinguished war records; some of them were used to run quick, complete, and accurate analyses on streams leading to and from the isomerization unit, thereby making it possible to maintain maximum production of the isobutane so urgently needed at that time in the manufacture of aviation alkylate. Still others give fast and extremely accurate determinations of the percent isobutylene in the total butane cut drawn from the catalytic cracking units.

Presently, analyses at the Physical Measurements Laboratory are saving valuable time by clipping hours off the time formerly required to run certain tests. Since the instruments require only very small samples, it is now possible to maintain thorough checks on the work of small pilot units doing research work. Both infrared and ultraviolet spectrometers are being used to control practically all operations at the government-owned, Humble-operated butadiene plant at Baytown, and a continuous ultraviolet recorder is used to follow operations in the final extraction unit at that plant.

Future applications of spectroscopic instruments appear unlimited. Preparations are already being made to install suitable models on plant equipment for continuous determination of product quality.

Considering what has already been done during the last five years, it seems within the bounds of reason to say that further application of these and other physical methods will continue to make industry's analytical tasks easier in the years to come.



OIL *in Galveston Bay*

Since Humble's Galveston Bay State A-1 came in a producer through casing perforations at 8,796 to 8,802 feet on August 19, 1940, the Company has developed the field gradually and in an orderly manner so that today it is one of the important off-shore producing areas along the Texas Gulf Coast. Known as Red Fish Reef field, it lies in the south-central portion of Galveston Bay, in Chambers County; roughly speaking, it is 10 miles off shore from district operating headquarters at Clifton-by-the-Sea on the west shore of the Bay and nine miles from Cedar Point on the north shore.

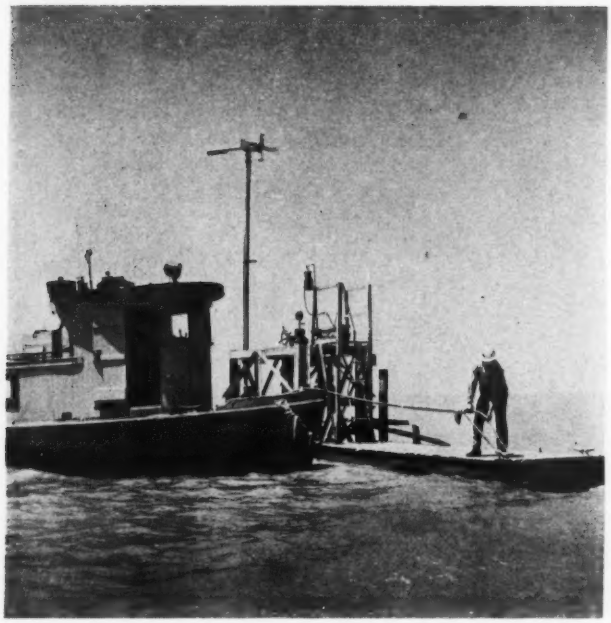
All wells in the field have been drilled from big submergible barge units, and there are in the field at present 16 producing oil wells and four gas-condensate wells. Daily oil production averages 2,000 barrels; condensate production about 775 barrels; and gas production in the neighborhood of 28,500,000 cubic feet.

Flow lines from producing wells to a central separator island, built on piling, are buried in the bay bottom; from this island, crude oil and condensate are delivered to Cedar Point through separate four-inch pipe lines and gas through a third eight-inch line.

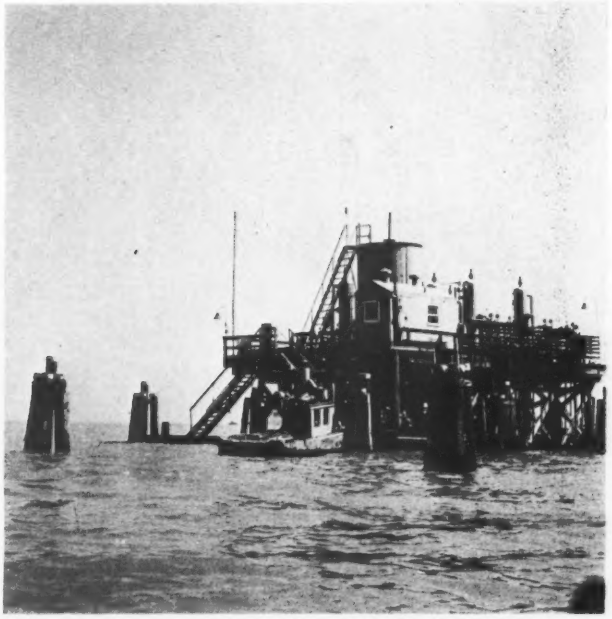
All producers are equipped with automatic safety (or storm) valves, set in the tubing string below water level. These are designed to avert the danger of a wild well in the event of damage to the well head.

Crews working on barge rigs and other projects in the field are transported to and from work by fast boats. Heavy equipment and servicing units are taken out by tug-towed barges.

WHEN A WELL has been completed the big submergible barge rig is floated to the surface and is towed by tugs to the next location.



PUMPERS IN the field make their rounds by boat and tie up at special landing platforms attached to each well guard. The windmill on the well generates electricity for a light which burns constantly as a warning signal. Production from all wells in the field flows through lines buried in the bottom of the bay to the central separator island shown below.



CREW MEMBERS on drilling rigs are transported to and from work in fast boats, and they bring their lunches with them. The other boat is a standby, kept at the rig at all times in case of emergency. Heavy equipment and servicing units are taken to the rig by tug-towed barges.

DAZZLING NIGHT VIEW OF BAYTOWN REFINERY. GRAVEYARD SHIFT EMPLOYEES GO ABOUT WORK AS USUAL UNDER LIGHTS

Around the Clock

While millions sleep, the world of oil moves on at a pace slackened only slightly by the setting sun

IN SPITE of what poets, tunesmiths, and writers of detective fiction would have us believe to the contrary, the night was made for other things besides a meeting time for lovers, or a sinister setting for some spine-tingling murder. While these exciting undertakings are in progress, a great many people are using the night for the more productive, if less romantic, purpose of keeping the wheels of industry turning.

Nightfall means nothing to men who are busy drilling new wells, manning pump stations, refining crude oil into finished products, and serving the needs of essential night travel and transportation. This is work which, by its very nature, must be kept going around the clock. If drilling rigs closed down at five o'clock; if engines at pump stations ground to a stop at dusk; if fires in refinery furnaces were snuffed out at sunset, the wheels of commerce, industry, business, and recreation would be short of fuels to power them and lubricants to keep them rolling.

So, while the world around them slumbers, oilmen are on the job. Humble drilling crews from New Mexico to Florida continue to make hole, continue to send heavy bits deeper into the earth, probing and questing for oil.

Ever see a drilling rig at night? It is a sight not soon forgotten; an experience that lingers in the memory. Go with us, then, to a rig neatly tucked away between bayous along the Texas coast. The main road to our rig bisects an already proven field; faint moonlight shining on aluminum-coated production tanks casts a light fluorescent glow here and there in the night. The stage setting is perfect; you are thinking in terms of oil long before you turn off the highway.

A short distance along a side road well-surfaced with shell, and there it stands—your drilling rig—looking for all the world like a small, garishly lighted carnival at a county fair. But you'll find no carnival spirit here; hundreds of thousands of dollars have been dedicated to the serious task of discovering and producing oil at this spot; members of the crew share with geophysicists, geologists, and engineers the determination to prove that Humble has invested those thousands wisely.

You have arrived during the four-to-midnight *tour*, pronounced *tower* by drilling men. There is a crew of five men, each of whom has a definite assignment. Off to the right, a boiler fireman emerges from surrounding shadows as he checks pressure and water level in four roaring boilers supplying steam for power. In a small, rain-proof shelter nearer the derrick, three men are mixing mud which must be circulated down through the drill pipe to lubricate the

SILHOUETTED AGAINST the darkness, the driller keeps a lonely vigil in the night, for unless a round trip is to be made or a joint of pipe is to be added, the other members of the crew are busy elsewhere around the rig.

bit, to bring cuttings to the surface, and to seal off possible blow-out of gas under pressure. Up there on the derrick floor, silhouetted against the darkness, is the man about whom our little universe revolves—the driller. Spotlights are brilliantly reflected from his polished aluminum safety hat as he goes about his duties. His is a lonely vigil in the night, for unless a joint of pipe is to be added or a round trip is in progress, the roughnecks who make up his crew are generally busy at points other than on the derrick floor.

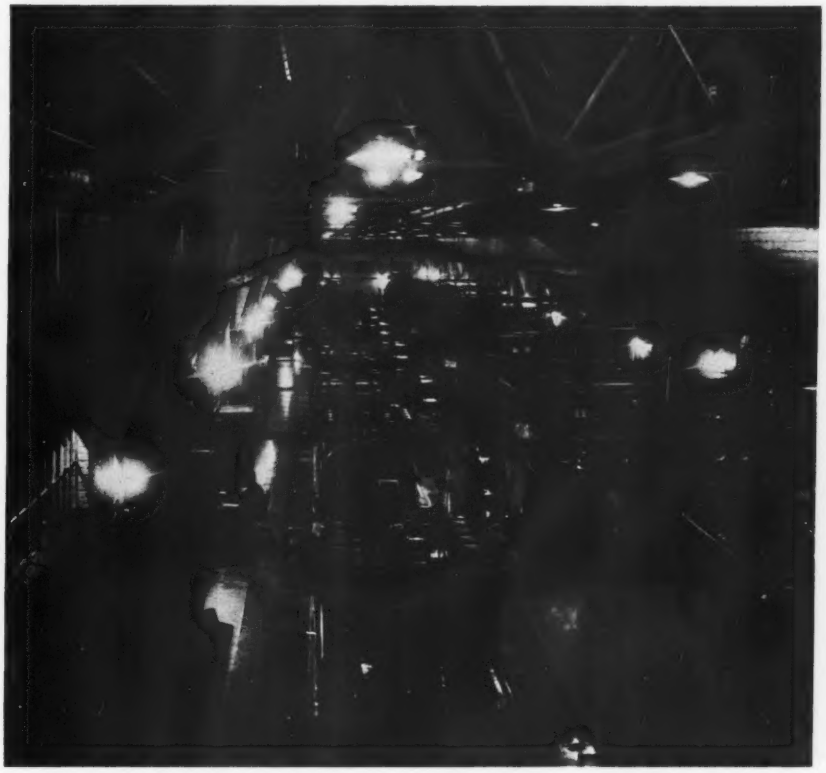
A cold rain has begun to fall; not a hard rain, just a depressing, bone-chilling drizzle blown along in sheets by wandering gusts. Taking brief refuge against the cold dampness, the mud-mixing crew gathers in the tool house for coffee and sandwiches. The boiler fireman joins them, wiping the cold mist from his glasses as he comes in out of the rain. For a few minutes there is complete relaxation, good food, and easy banter; then crew members fade back into the night to resume their duties. Someone remembers to take the driller a mug of steaming coffee to go with his mid-tour lunch.

Hours slip by, and you are just getting interested in your subject when headlights bobbing down the lane advertise the coming of the graveyard crew, who will take over at midnight and work until eight in the morning. As members of the present tour shrug wearily out of coveralls and khakis into clean clothes, let's move on to the next phase of night operations, a pump station in the Humble Pipe Line Company system, and see how oil is distributed after it is produced.

Webster pump station is a plexus of pipe lines gathering oil from many points in Texas and distributing it to refineries and loading centers along the Gulf Coast. Great steel arteries, pulsing with their precious burden of oil, bring to Webster oil from hundreds of pools in widely separated parts of Texas and New Mexico; from here, it is rerouted for shipment and refining.

Seen from the highway, the blazing lights of Webster station might easily be mistaken for those of a small town or

ROW ON ROW of great engines (below) throb tirelessly through the night as they pump oil from Webster pump station to Baytown refinery and Texas City terminal.



perhaps a large military reservation. An alert guard checks your identification, swings a heavy gate wide, and directs you to the main pump house. This is a big place; row on row of great engines, glistening with new paint under the glare of artificial light, throb tirelessly as they pump oil to Baytown and Texas City. There is evidence of spotless housekeeping; the gray-and-green floor is polished to a high gloss; several men move about, cleaning real and imaginary flecks of oil from their machines.

Across the street, in a tidy brick building, a telegraph operator dispatches information on the night's receipts and shipments to an operator in the main office at Houston. Gaugers, their flashlights thrust jauntily into hip pockets, come in out of the night for a cup of coffee before taking their next check on storage tanks. Outside, in front of the building, a concentration of valves and pipes projected against a backdrop of night sky looks like something out of a surrealist's dream.

It's late, and you're getting sleepy. Baytown refinery still remains to be visited, but you'd better save that for tomorrow night. The refinery is a big place, an important place; let's take a whole night for the job.

The following night you arrive at Baytown in time to see employees coming in for the graveyard shift. (Refinerymen call it a *shift*, rather than a *tour*). Between 11:15 and 11:45, hundreds of graveyarders converge on the clockhouse gate. From everywhere they come; some by rail, some on foot, some in the family car, and many on bicycles. During that busy hour, members of the plant protection department have a brisk time of it, checking each man for proper identification, making sure that he carries no out-law (strike-anywhere) matches, and taking other precautions that no unauthorized person or material enters the plant.

Most of the incoming employees, after punching their time cards, stop a moment in the clockhouse yard for a last cigarette. Squatting comfortably in broad semicircles or leaning against a friendly wall, they discuss matters and problems common to the graveyard

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THE TOOL HOUSE is where members of the drilling crew gather to enjoy a midnight lunch of sandwiches and coffee. Plant protection officers (left) have a busy time of it checking in Baytown's graveyard shift as hundreds of employees converge on the plant afoot and on bicycles between 11:15 and 11:45 p.m.

fraternity: how much sleep they had today; how much noise Junior and the neighbor's children made; and how many more graveyards each has yet to work. They drift away toward their jobs in groups of two and three, snapping glowing cigarette stubs into the sandy floor of the clockhouse yard as they leave. By midnight, every man is functioning at his post; the graveyard shift has begun.

Making your way around the plant at night, you notice a "business as usual" atmosphere. Firemen stalk back and forth between furnaces of a distillation unit, occasionally stopping under a light to record in a little notebook fuel gas pressures for each still. A process helper clumps out of the unit's receiving house and mounts a flight of stairs leading to the top of a bubble tower, climbing higher and higher until only the rhythmical bobbing of his flashlight's beam is visible in the murky blackness.

In one corner of the receiving room, the houseman takes a batch of naphtha samples, weighs each sample, and records his findings on the night's log. At the other end of the room, a little group has already begun to gravitate toward the steam cooker, where the early morning coffee ritual is in progress. Someone invites you to have a cup. It is hot, heady brew, the sort you'd expect graveyarders to drink. There's neither cream nor sugar, and you down the potent black stuff in scalding mouthfuls. Someone begins to peel potatoes in anticipation of an early lunch.

There is no regularly scheduled lunch period for the graveyard shift. As duties permit during the morning, the same steam plate which heated your coffee will be used to broil many a juicy steak or chop, some of them flanked, perhaps, by "French fries" or onion rings. Graveyard work, you observe, is not without certain compensations.

You leave the distillation unit and proceed toward one of the tall catalytic cracking units whose strings of lights from top to bottom give it the appearance of a glorified Christmas tree. Heavy trucks rumble by, laden with material checked out of the storehouse a few minutes ago and earmarked for some repair job. Repair and maintenance work goes on day and night; the mechanical department, too, has its graveyard shift.

After an interesting inspection of the great catalytic cracking unit, including a breath-taking night view of the refinery from its 260-foot crest, you prepare for the trip home.

Your nocturnal odyssey is completed with a stop at an all-night Humble service station. Here is truly an oasis in the night for many a tired truck driver carrying food and other supplies across country, and for many a motorist on a vital mission. While your gasoline tank is being filled, a heavy truck loaded with dairy products rolls into the driveway and comes to a stop. Behind the wheel is a burly, friendly fellow typical of the trucking gentry. He clambers from the cab, stretches his legs at bit, and calls for "the works."

While the driveway salesman is checking under-the-hood points, a car skids to a halt at the far end of the pump island. Obviously in a hurry, the customer inquires: "Could I have 10 gallons right away? Got an emergency call some distance out in the country." With an understanding nod, the truck driver defers to the doctor, and the salesman quickly supplies the gasoline.

Others like these two have stopped here tonight; still others will follow. It is the driveway man's duty to keep 'em rolling through the night.

It is here in the service station, then, with the first hint of dawn streaking the sky, that pieces of the oil-by-night jigsaw puzzle begin to fit into an orderly picture.

You understand now why these operations are carried on around the clock.

HERE IS TRULY AN OASIS IN THE NIGHT FOR TIRED TRUCK DRIVERS AND FOR MOTORISTS WHO MUST KEEP GOING

By the way . .

Contrary to Mark Twain's much-quoted adage, something is going to be done about the weather in Texas in the near future. A foundation research project for locating and tracking storms in the Gulf of Mexico, sponsored jointly by Humble Oil & Refining Company and Dow Chemical Company, will be started soon at Texas A & M College.

A weather station will be established on the campus and at least one more will be set up on the Gulf coast. Storms and disturbances coming up from the tropics will be logged and tracked by radio direction-finding equipment. Eventually it is hoped that the station will also do some research work on inland disturbances, including the study of "blue northers" so common to Texas during the winter.

A and T Plan Well Received

Employees of the Humble Companies received enthusiastically the revised Annuity & Thrift Plan, which was adopted on January 1, 1946, according to a recent report by the trustees. Participation increased from 94.9 per cent of eligible employees under the old plan to 97.95 per cent under the revised plan; moreover, there was an increase from 67.2 per cent to 79.2 per cent in employees participating to the maximum extent, the report indicated.

Transfers and Promotions

Effective February 16, Humble Oil & Refining Company established Hub district headquarters in Columbia, Mississippi, with operations under the supervision of W. T. DABBS, District superintendent, and B. H. C. STOVER, District chief clerk, both of whom were transferred from similar positions at the Eucutta district office at Waynesboro, Mississippi. Supervision of the latter district was changed at the same time with the transfer of S. E. WALLETTE, from the position of farm boss at Bayou Sale district, Franklin, Louisiana, to position of district superintendent at Eucutta. J. M. BARBER, district chief clerk at Heyser Gas Plant in the Southwest Texas division, was transferred to the same position at Eucutta.

Recent returnees from military service who are back at their posts in the Production department include: M. U. BATEMAN, chief clerk at Heyser Gasoline Plant, after two years of service in the Army; V. A. CARPENTER, assistant chief clerk at Friendswood, Gulf Coast division, after two years in the Navy; D. D. DENNISON, Houston Office Production accounting, after more than three years in the Navy; W. W. PETTY, assistant chief clerk in the Andrews district, after more than three years in the Navy; and V. L. WIMBERLY, chief clerk of the Katy Products Line construction district, after more than five years service in the Army.

Retirements

JAMES W. DEHAY, roustabout at Tomball, on January 21 . . . WILLIAM D. CLEMENTS, first class helper in distillation department, Baytown refinery, on January 26 . . . ROBERT W. RICHARDSON, light oil treater foreman at Baytown refinery, February 1 . . . JOHN H. STAMPS, crum boss at Mean, Production department, on February 5 . . . DANIEL D. MORSE, Production accounting, Houston Office, on February 9 . . . LUTHER B. MACKRELL, first class helper at Baytown refinery, on February 18 . . . L. D. HARRIS, pipe machine operator at Baytown refinery, on February 27 . . . and MRS. WILLIE MCLEROY, PBX operator for Humble Pipe Line Company at Cisco, on February 28.

The HUMBLE WAY

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Published every other month for employees and stockholders

HUMBLE OIL & REFINING COMPANY

P. O. BOX 2180, HOUSTON 1, TEXAS

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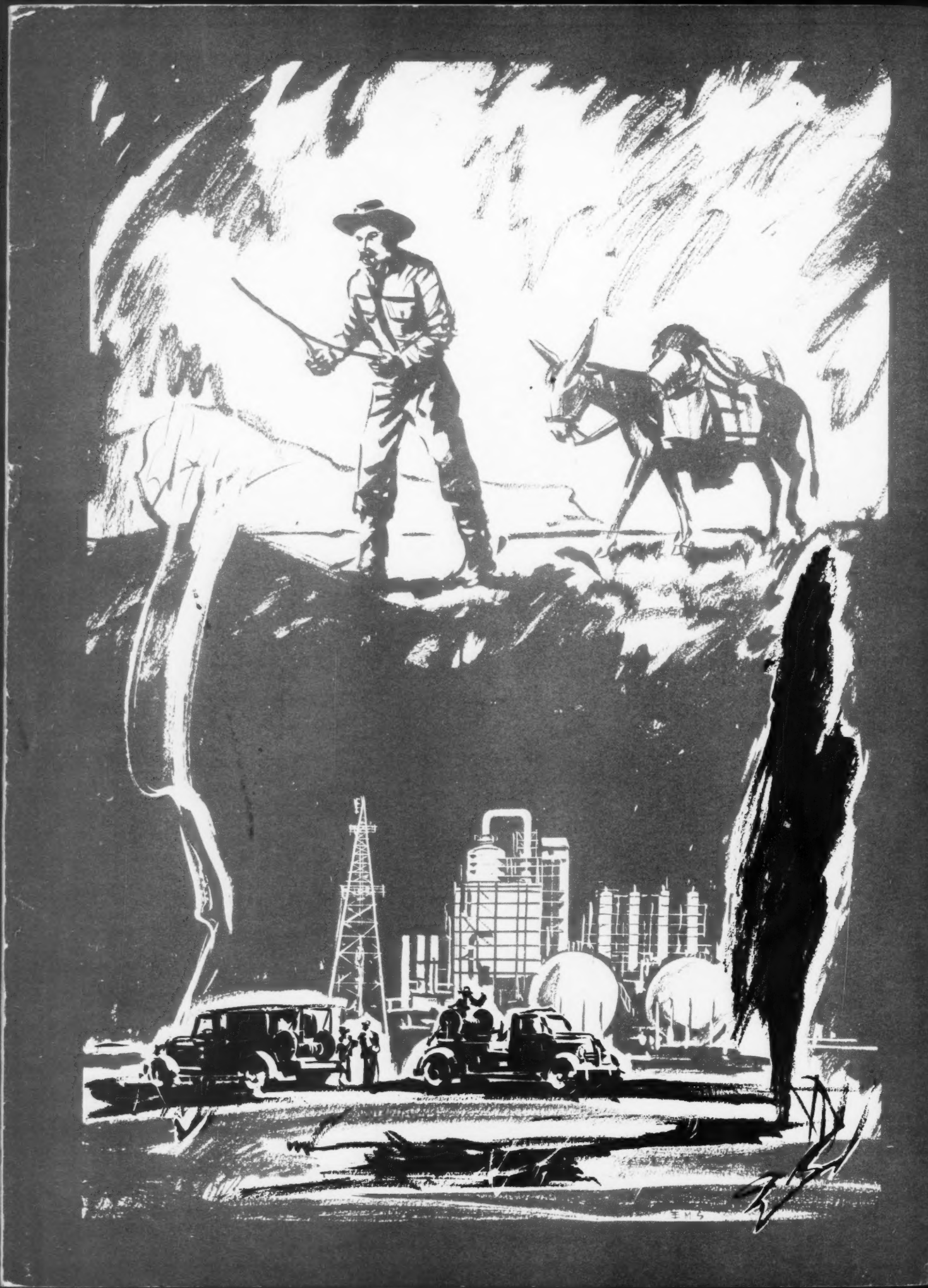
Front and back cover painting: E. M. Schiwetz.

Deaths

ALTON BROOKS HALE, 36, maintenance helper at Baytown refinery, on January 3 . . . EARL L. BUCHANAN, 41, lineman in Telephone and Telegraph division of Humble Pipe Line Company, on January 28 . . . GUY F. NEWMAN, 38, maintenance helper at Baytown refinery, on January 30 . . . HAROLD L. EBERLY, 36, first class helper at Baytown refinery, on January 31 . . . LORENZO J. HUNT, 32, second class helper at Baytown refinery, on January 4 . . . HIRAM E. HAYES, 41, order preparation helper at Baytown refinery, on February 14 . . . VINET A. SOCKWELL, 49, mechanical supervisor in the Production department at Talco, on February 24 . . . and EDWARD H. BOWEN, 53, stock gauger for Humble Pipe Line Company at Baytown, on February 18 . . . Annuitants who have died since last publication date are: WILLIAM N. MOORE, 77, watchman at Ingleside refinery until his retirement on January 1, 1936, died on March 5 . . . and JOSEPH C. HANRAHAN, 52, division superintendent at Cisco for Humble Pipe Line Company until his retirement on January 27, 1944, died on March 17.

PUNCHING IN time finds a steady stream of graveyard shift workers filing through the clockhouse at Baytown refinery.